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TRANSMITTAL OF APPEAL BRIEF (Large Entity)	Docket No. 102.117
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Application Of: Eric W. Kramer et al

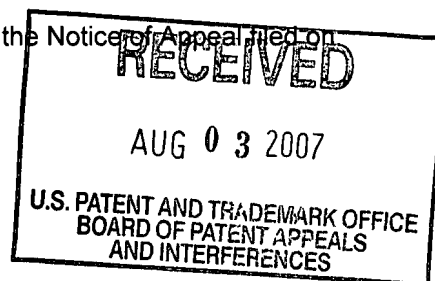
Application No. 10/798,752	Filing Date 03/10/2004	Examiner Nguyen, Hoa Cao	Customer No. 66381	Group Art Unit 2841	Confirmation No. 6430
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Invention: **REPLACEABLE LED MODULE**

COMMISSIONER FOR PATENTS:

Transmitted herewith is the Appeal Brief in this application, with respect to the Notice of Appeal filed on
May 30, 2007

The fee for filing this Appeal Brief is: \$500.00



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Dated: July 31, 2007

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Attorney's Docket No. 102.117

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In the application of:

Eric W. Kramer et al

Serial No.: 10/798,752

Filed: March 10, 2004

For: REPLACEABLE LED MODULE

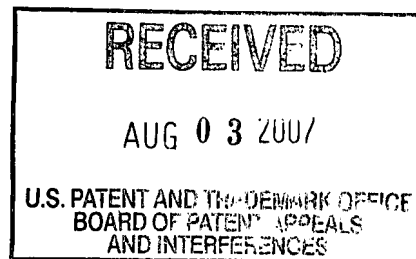
Examiner: Nguyen, Hoa Cao

Group Art Unit: 2841

APPELLANTS' BRIEF

APPEAL BRIEF

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Sir:

This is an appeal from the Office Action, dated November 30, 2006, finally rejecting Claims 3 and 13-16, inclusive.

Real Party in Interest

Eric W. Kramer, Thomas T. Nagano and Kiem Lee are the named inventors for this patent application. Each has an agreement to assign the application and/or resulting patent to Tivoli LLC. Accordingly, the real party in interest is Tivoli LLC, which is jointly owned by Neo-Neon Holdings, Ltd. and Targetti North America, Inc., a wholly owned subsidiary of Targetti Sankey.

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Related Appeals and Interferences

There are no related appeals or interferences known to Appellants, the Appellants' legal representative, or Assignee that will directly affect or be directly affected by or have a bearing on the Board's decision on this appeal.

Status of the Claims

Claims 3 and 13-16, inclusive, are pending and stand rejected. Claims 3, 13-14 and 16 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. Appl. No. 2003/0207609 ("Hatton") in view of U.S. Pat. No. 6,551,124 ("Gossman.") Claim 15 was rejected as being unpatentable over Hatton in view of Gossman and U.S. Pat. No. 5,451,174 ("Bogursky.") The rejections of Claims 3 and 13-16 are the subject of this Appeal.

Status of Amendments

No amendments to the claims after the final rejection have been filed. Applicants filed a response to the final office action that was not entered by the Examiner.

Summary of Claimed Subject Matter

The present invention is an improved replaceable LED module. ("Technical Field," p. 1.) In particular, the present invention is directed to an environmentally resistant LED module for mounting on at least a pair of electrical leads with a non-conductive sheath surrounding conductive wire. *Id.* The LED module 10 comprises a circuit board 20 secured to a base 30 containing at least two electrical leads 100 and 105.

(See “Detailed Description,” p. 3, ¶2. and Figures 1 and 2.) The circuit board 20 has an LED 25 and at least two contact teeth 24 and 26 whereby each contact tooth makes electrical contact with one of the at least two electrical leads 100 and 105. (See “Detailed Description,” p. 3, ¶2 and ¶5 and Figures 1 and 3.) A gasket 40 with a thickness covers a side of the circuit board 20 where the at least two contact teeth 24 and 26 traverse the thickness of the gasket 40 to make electrical contact with the at least two electrical leads 100 and 105. (See “Detailed Description,” p. 4, ¶¶5-6 and Figures 1 and 4.) The gasket 40 is preferably vinyl foam tape and preferably attached to the circuit board 20 by pressure sensitive double-sided adhesive. (See “Detailed Description,” p. 4, ¶6.) The circuit board 20 preferably further comprises a shoulder mount 27 to support each contact tooth 24 and 26. (See “Detailed Description,” p. 5, ¶8 and Figure 3.) The contact teeth 24 and 26 are preferably each coated in wax. (See “Detailed Description,” p. 5, ¶8.)

Grounds of Rejection to be Reviewed on Appeal

Whether Claims 3, 13-14 and 16 are unpatentable under 35 U.S.C. §103 over U.S. Pat. Appl. No. 2003/0207609 (“Hatton”) in view of U.S. Pat. No. 6,551,124 (“Gossman.”) Whether Claim 15 is unpatentable under 35 U.S.C. §103 over Hatton in view of Gossman and U.S. Pat. No. 5,451,174 (“Bogursky.”) The rejections of Claims 3 and 13-16 are the subject of this Appeal.

Argument

I. INTRODUCTION

In proceedings before the Patent and Trademark Office, the Patent Office bears the burden of establishing a *prima facie* case of obviousness based upon the prior art. The United States Supreme Court in *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1737-38 (2007) admonished:

As is clear from cases such as *Adams*, a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known. (emphasis added)

The Federal Circuit advised, "[The Examiner] can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." *In re Fritch*, 23 USPQ 2d 1780, 1783 (Fed. Cir. 1992)(citing *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ 2d 1596, 1598 (Fed. Cir. 1988).) The Office Action fails to show any reason or teaching that would lead to the combination of the references cited. In particular, the Hatton and Gossman references are from non-analogous sources that would not have been combined by one ordinarily skilled in the art of LED lighting. Accordingly, the claim rejections are clearly erroneous and should be reversed.

II. CLAIMS 3 AND 13-16

A. CLAIMS 3 and 13-16

The Hatton reference is for a “Paperless Picking System” in the field of paperless, order assembly. (Exhibit A, p. 13, “Field of the Invention.”) Hatton states, “Modern distribution centers utilize a network of electronic devices for managing order picking operations. Human pickers are guided to zones, bays and individual locations for picking, by light emitting devices.” (Exhibit A, p. 14, “Preferred Embodiments of the Invention, ¶39.) The Gossman reference is for a “Contacting Device for a Flat Band Cable.” (Exhibit B, Title page.) The Gossman patent specifically refers to “building technology,” the automotive sector and industrial control and automation technology. (Exhibit B, Col. 1, ll. 13-15.)

Two criteria have evolved for determining whether prior art is analogous: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the inventor’s endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved. *In re Deminski*, 796 F.2d 436, 442 (Fed. Cir. 1986); *In re Wood*, 599 F.2d 1032, 1036 (CCPA 1979). The Court in *In re Wood*, *supra*, explained:

The rationale behind this rule precluding rejections based on combination of teachings of references from nonanalogous arts is the realization that an inventor could not possibly be aware of every teaching in every art. Thus, we attempt to more closely approximate the reality of the circumstances surrounding the making of an invention by only presuming knowledge by the inventor of prior art in the field of his endeavor and in analogous arts. *Id.* at 1036.

Neither reference discusses the use of LEDs for the theater or auditorium environment, as does the present application. *See* Applicants’ specification, p. 1, “Background Art.” More importantly, the Examiner does not identify any objective reason in the prior art

why the Hatton and Gossman references would be combined. Instead, the Final Office Action states in conclusory fashion:

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form a gasket 6, as taught by Gossman, with a thickness covers a side of the circuit board where the at least two contact teeth 46 traverse the thickness of the gasket to make electrical contact with the at least two electrical leads 26 in order to provide a sealing between contacts. (Final Office Action, p. 3.)

This statement does not satisfy the requirements of a *prima facie* case of obviousness. The combination of elements from non-analogous sources, in a manner that reconstructs the applicant's invention only with the benefit of hindsight, is insufficient to present a *prima facie* case of obviousness. There must be some reason found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination. That knowledge cannot come from the applicant's invention itself. See *In re Oetiker*, 24 USPQ 2d 1443, 1446 (Fed. Cir. 1992).

The Gossman reference does not show the use of a gasket to protect a circuit board. Instead, the gasket 6 is inserted between a flat conducting cable and a “contacting device 2.” The Gossman reference further explains that it is preferable that the plug connector for the contacting device described in the application be for connection to a circuit board. (Exhibit B, Col. 3, lines 44-53.) Thus, the location of the device in Gossman is removed from the circuit board to further isolate the circuit board from the connection environment. Thus, Gossman teaches away from the use of a gasket in combination with and actually covering a circuit board or, more importantly, for use with the device in the Hatton reference.

Moreover, the Hatton reference discloses a device 40 that clamps onto a rail 10 to enclose pins 46 penetrating leads 26, essentially a groove-spring configuration. See

Exhibit A, Figures 4 and 7. Conversely, the Gossman reference teaches away from such a configuration by use of the gasket 6 by stating, “At the same time the need for a demanding groove-spring configuration drops out, since the gasket need not have a groove in the region of the sealing edge.” (Exhibit B, Col. 2, ll. 5-8.) Thus, not only are there no reasons in the prior art to combine the Hatton and Gossman references, there are express reasons stated in Gossman that dictate against such a combination. The rejection of Claims 3 and 13-16 was clearly erroneous and should be reversed.

B. CLAIM 13

Furthermore, with regard to Claims 13-14 and 16, neither the Hatton nor Gossman references disclose the limitations offered by those dependent claims. For example, in Claim 13, neither Hatton nor Gossman disclose a gasket made of vinyl foam tape. This rejection is erroneous and should be reversed.

C. CLAIM 14

For Claim 14, the references do not disclose the use of double-sided adhesive to attach the gasket to the circuit board. Contrary to the Office Action’s assertion, this is not a “process limitation.” (Final Office Action, p. 4.) Double-sided adhesive, just like screws or nails, is a structural limitation in the claim, not a process limitation. This rejection is erroneous and should be reversed.

D. CLAIM 16

For Claim 16, the references do not disclose a coat of wax on the contact teeth.

This rejection is erroneous and should be reversed.

Thus, the office action fails to make a *prima facie* case of obviousness by identifying each and every element of Claims 13-14 and 16 in the prior art. These rejections are erroneous and should be reversed.

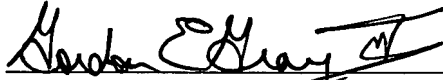
Conclusion

The Examiner's rejections are clearly erroneous and should be reversed.

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Gordon E. Gray III


Typed or Printed Name of Person Mailing Correspondence


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CLAIMS APPENDIX

3. An LED module comprising:

a circuit board secured to a base containing at least two electrical leads;

the circuit board having an LED and at least two contact teeth whereby each contact tooth makes electrical contact with one of the at least two electrical leads;

where a gasket with a thickness covers a side of the circuit board where the at least two contact teeth traverse the thickness of the gasket to make electrical contact with the at least two electrical leads.

13. The replaceable LED module of Claim 3 where the gasket comprises vinyl foam tape.

14. The replaceable LED module of Claim 3 where the gasket is attached to the circuit board by pressure sensitive double-sided adhesive.

15. The replaceable LED module of Claim 3 where the circuit board further comprises a shoulder mount for each contact tooth.

16. The replaceable LED module of Claim 3 where the at least two contact teeth are each coated in wax.

EVIDENCE APPENDIX

Attached hereto are true and correct copies of U.S. Pat. Appl. No. 2003/0207609 to Hatton (attached hereto as Exhibit A); U.S. Pat. No. 6,551,124 to Gossman (attached hereto as Exhibit B); and U.S. Pat. No. 5,451,174 to Bogursky et al (attached hereto as Exhibit C) as cited by the Examiner in support of the rejections at issue in this appeal.



US 20030207609A1

(19) **United States**(12) **Patent Application Publication****Hatton**(10) **Pub. No.: US 2003/0207609 A1**(43) **Pub. Date:****Nov. 6, 2003**(54) **PAPERLESS PICKING SYSTEM****Publication Classification**(75) **Inventor:** Gerry Hatton, Frenchs Forest (AU)(51) **Int. Cl.⁷** H01R 4/24; H01R 4/26;

H01R 11/20

(52) **U.S. Cl.** 439/425

Correspondence Address:

VAN DYKE, GARDNER, LINN AND**BURKHART, LLP****2851 CHARLEVOIX DRIVE, S.E.****P.O. BOX 888695****GRAND RAPIDS, MI 49588-8695 (US)**(57) **ABSTRACT**

The invention pertains to picking systems and more particularly to a paperless, order assembly system.

(73) **Assignee:** Mannesmann Dematic Colby Pty Limited, Frenchs Forest (AU)

The invention provides an elongate support rail (11) and a location or zone level data device (40) for a paperless picking system, the rail (11) having a plurality of longitudinally extending spaced apart channels (13) formed therein, each channel defining an opening into which may be inserted one or more lengths of insulated conducting wire (26), the location or zone level data device (40) being attachable to a front face of the rail and having a plurality of penetrating pins (45) corresponding generally in lateral spacing to the channels (13) in the support rail, the pins (45) being adapted to penetrate the insulation of the wire (26) with the device in an operational position, thereby to provide an electrical connection between the device and the wire at selected locations on the support rail.

(21) **Appl. No.:** 10/407,396(22) **Filed:** Apr. 4, 2003**Related U.S. Application Data**

(63) Continuation of application No. 09/161,151, filed on Sep. 25, 1998, now Pat. No. 6,544,068.

(30) **Foreign Application Priority Data**

Sep. 26, 1997 (AU) P09472

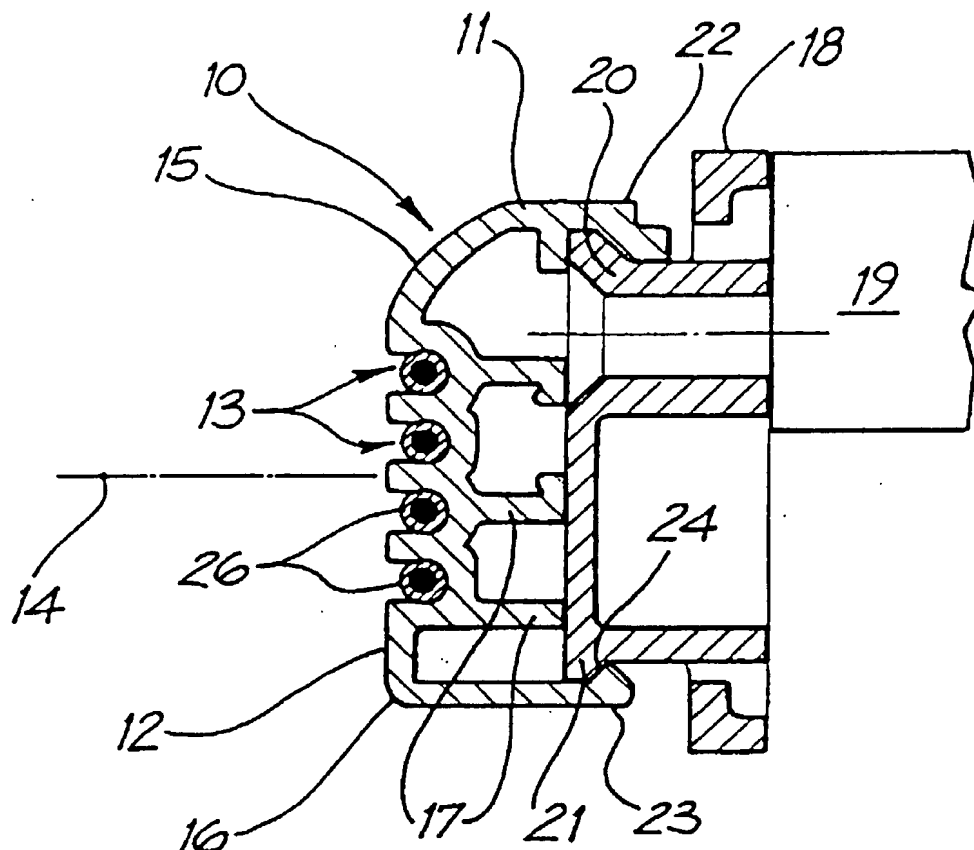


EXHIBIT A

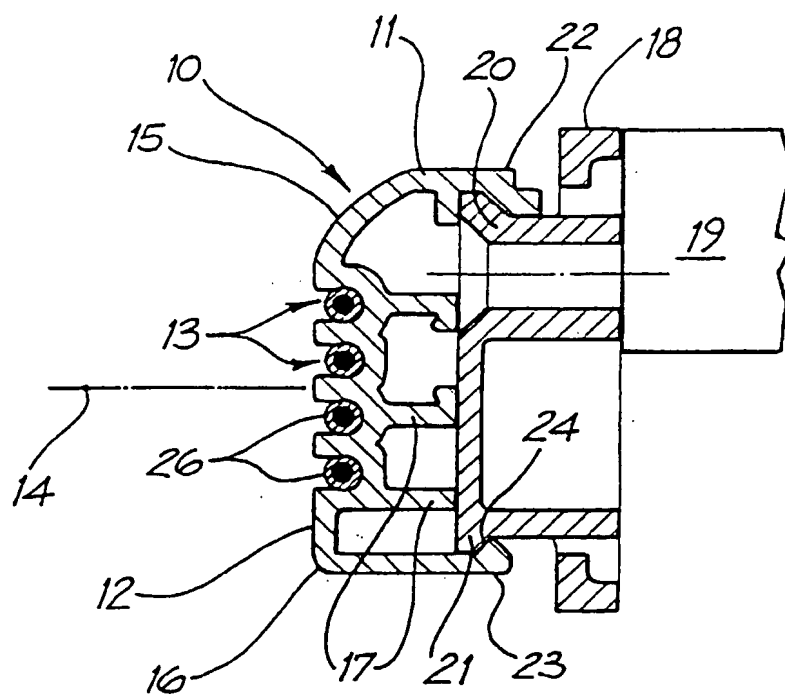


FIG. 1

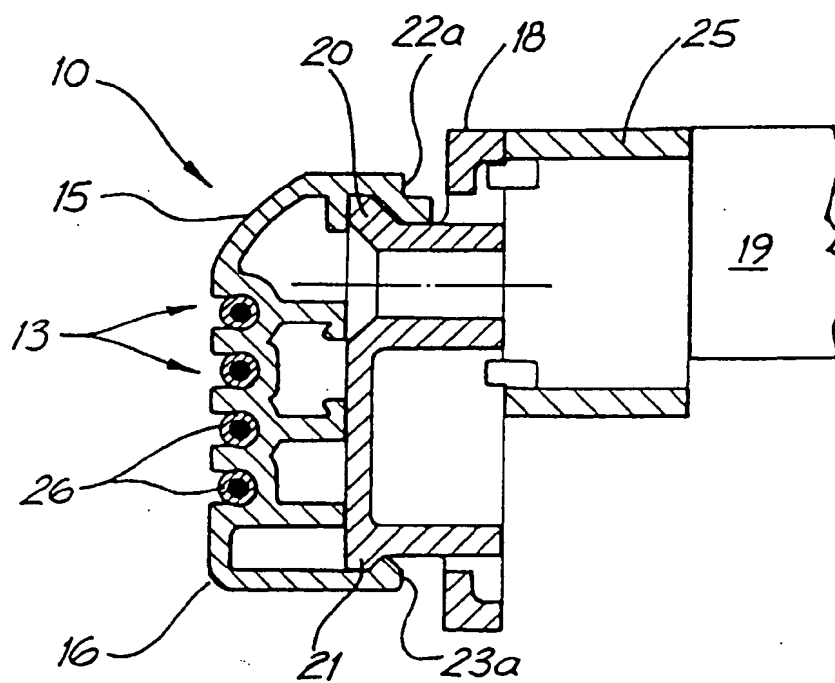


FIG. 2

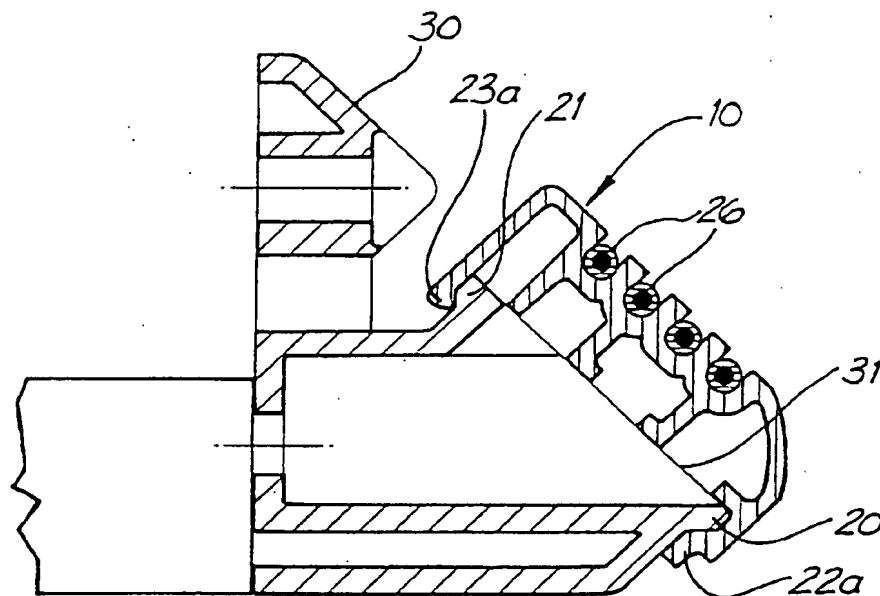


FIG. 3

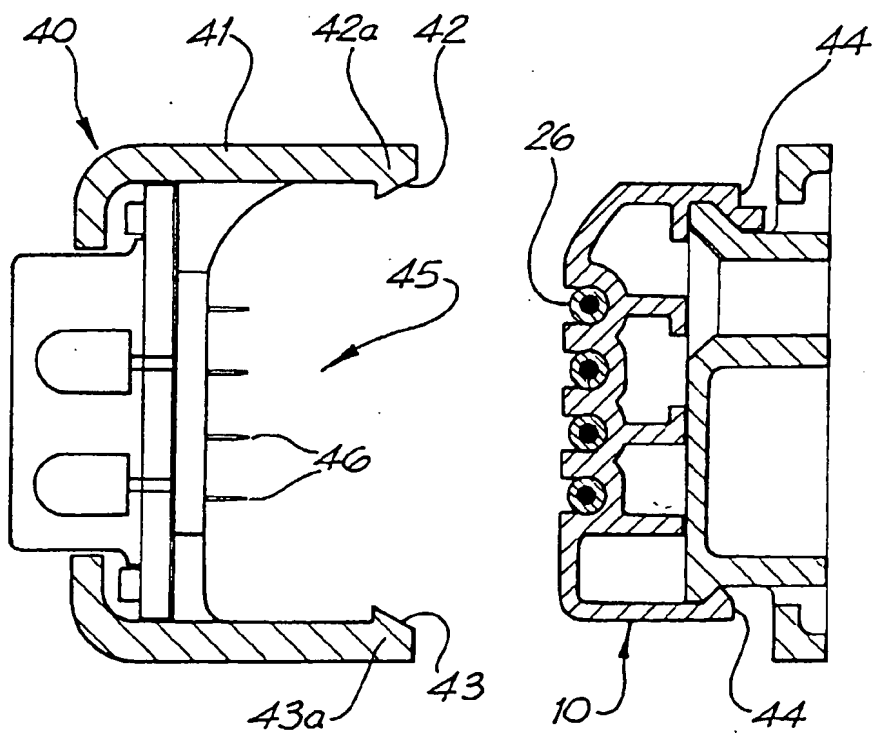
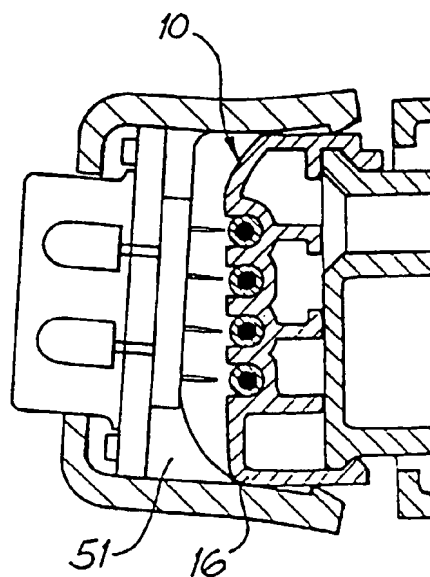
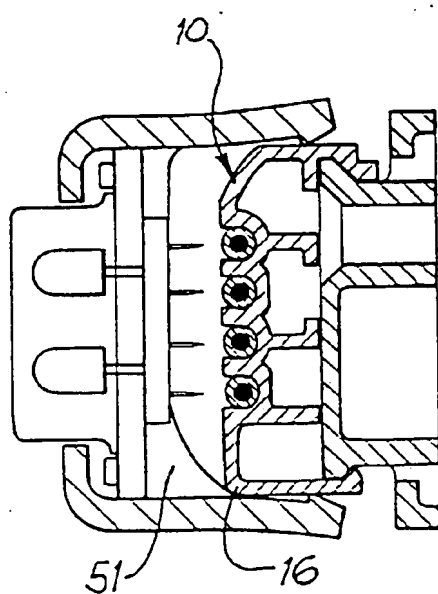
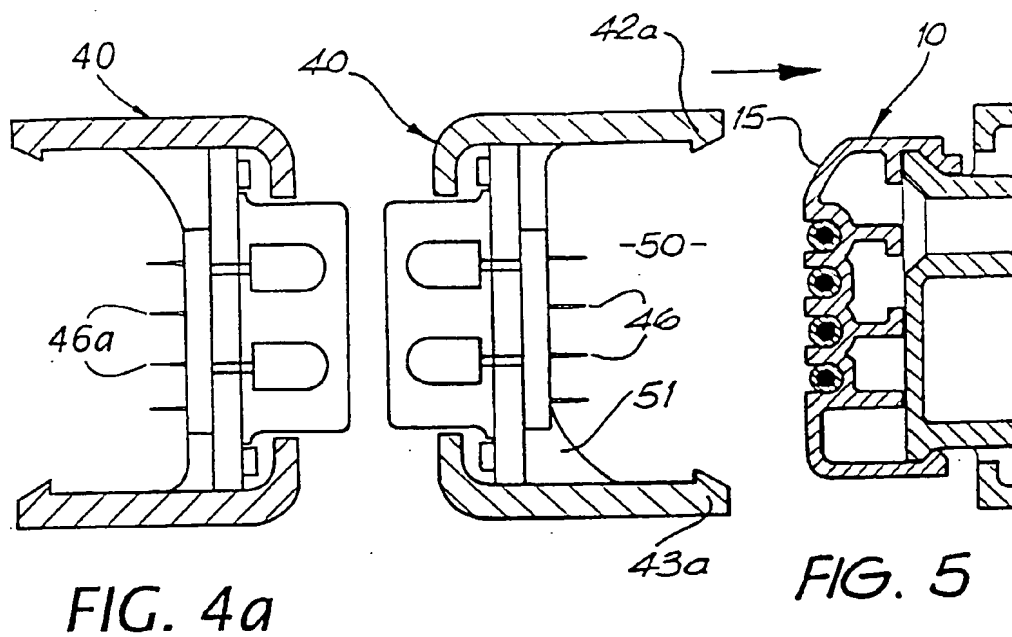


FIG. 4



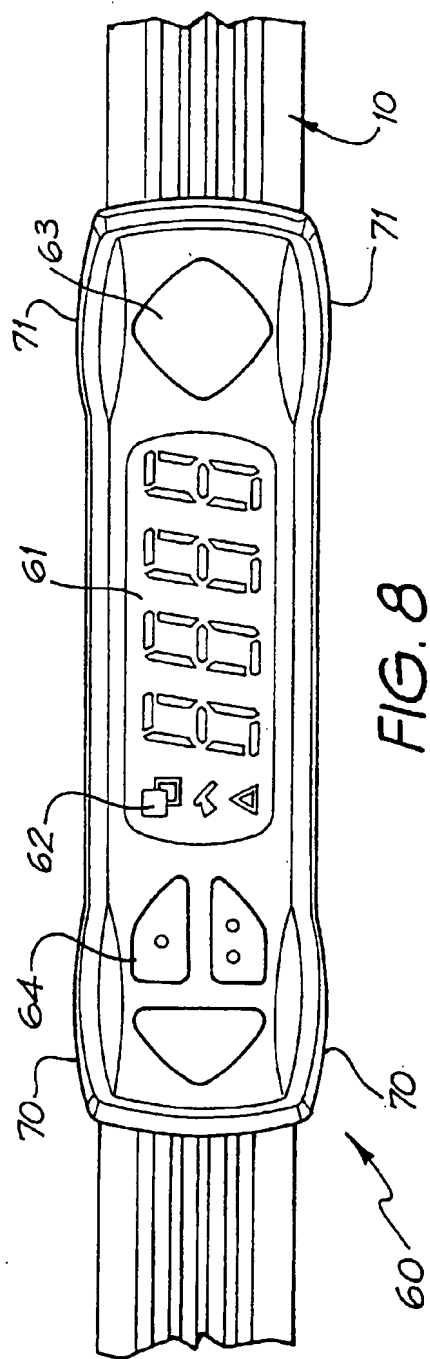


FIG. 8

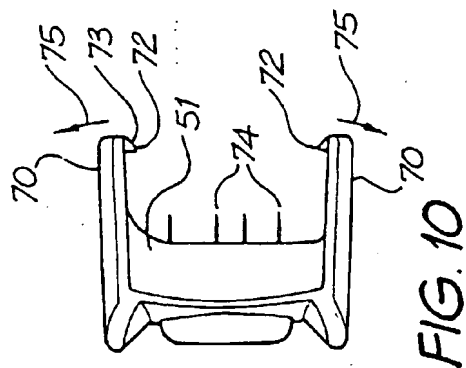


FIG. 10

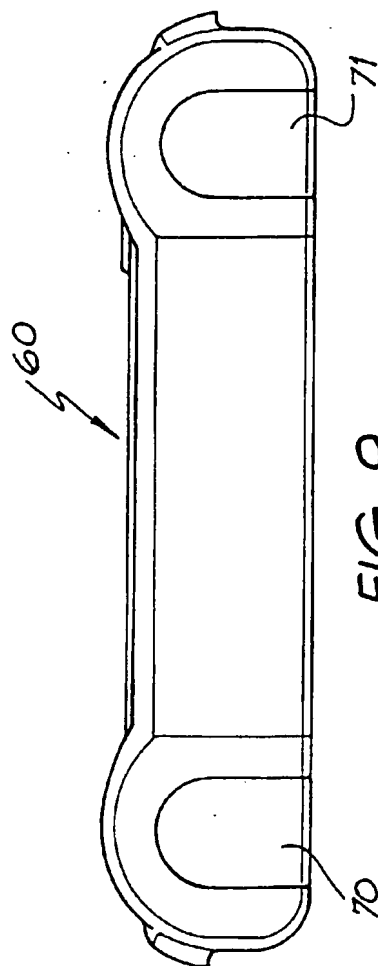


FIG. 9

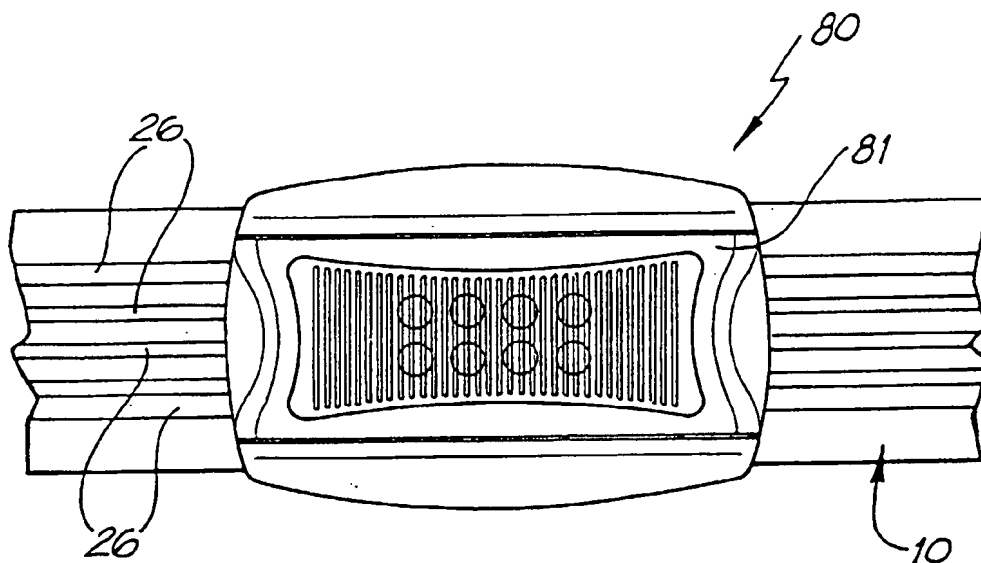


FIG. 11(a)

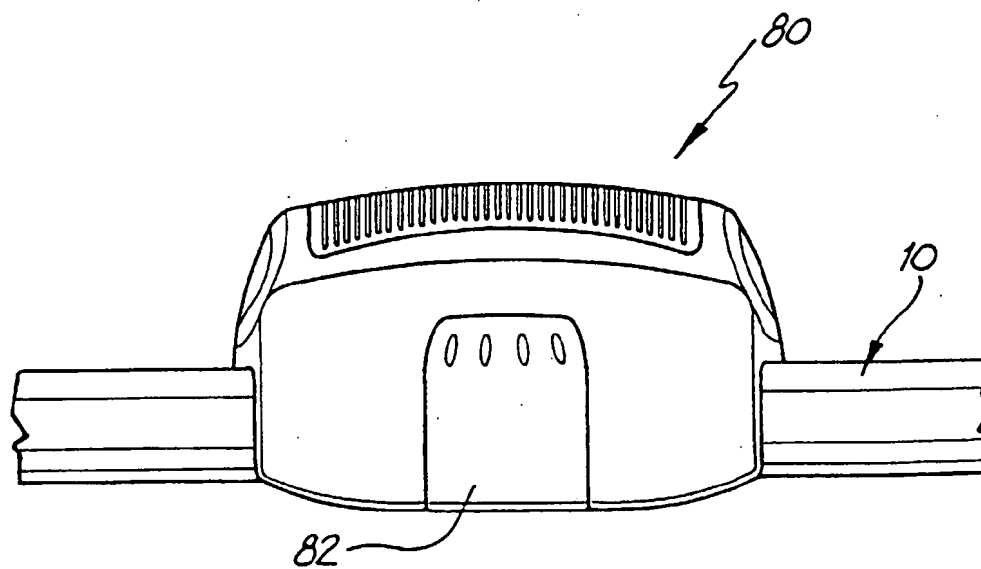


FIG. 11(b)

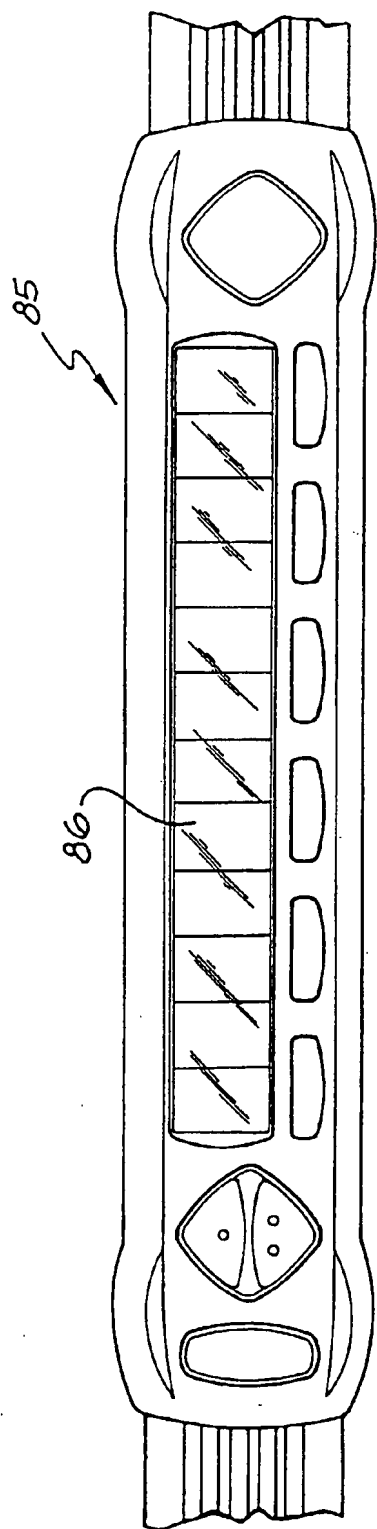


FIG. 12(a)

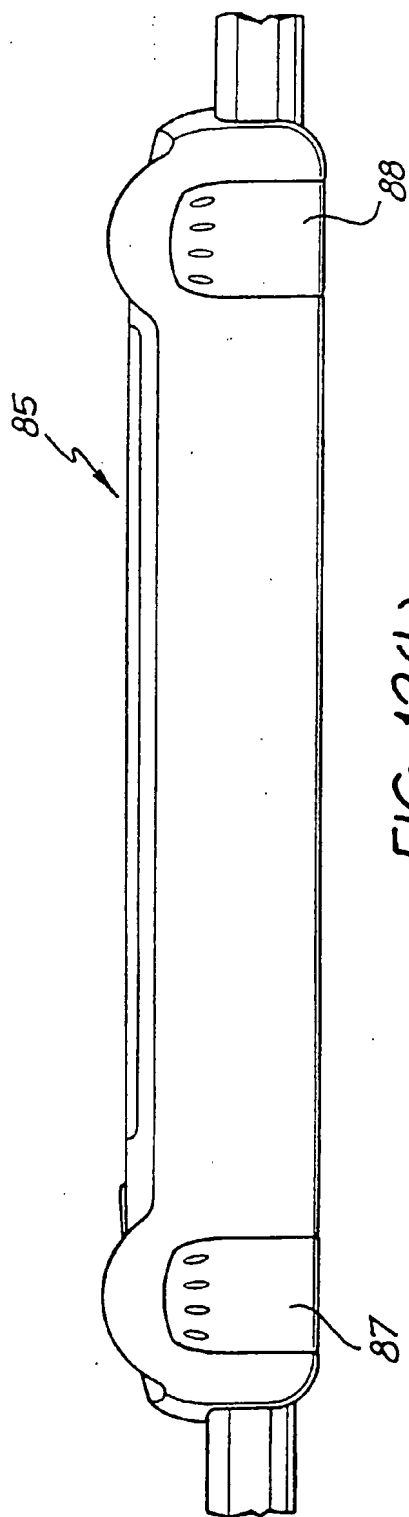


FIG. 12(b)

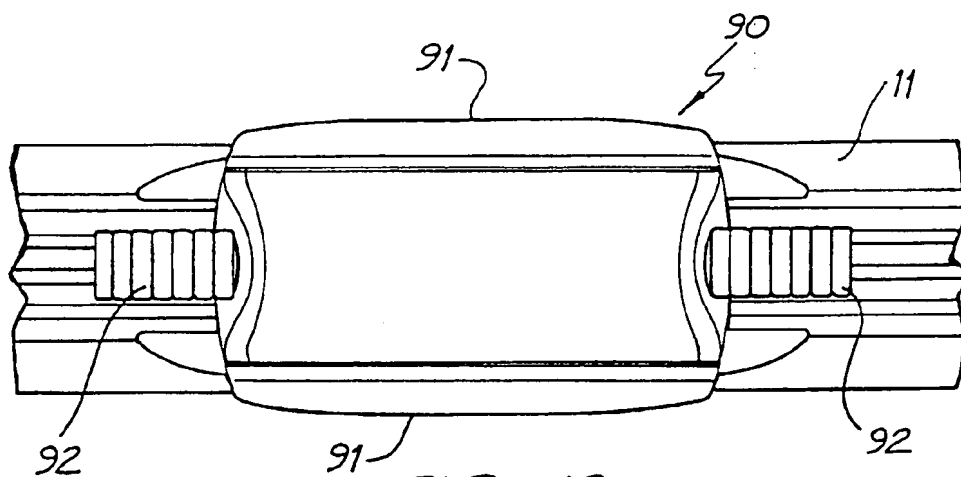


FIG. 13(a)

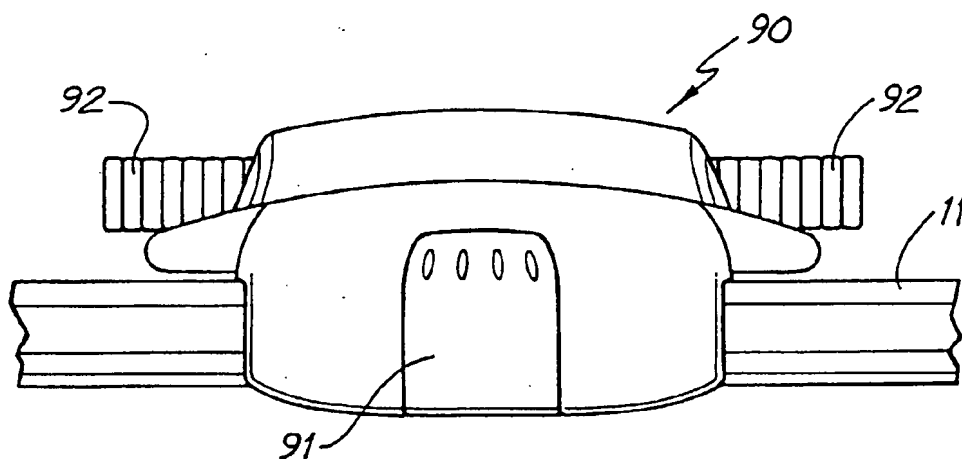


FIG. 13(b)

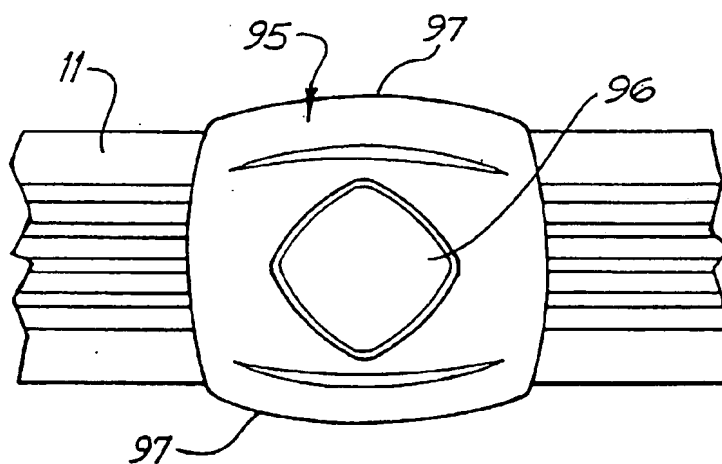


FIG. 14

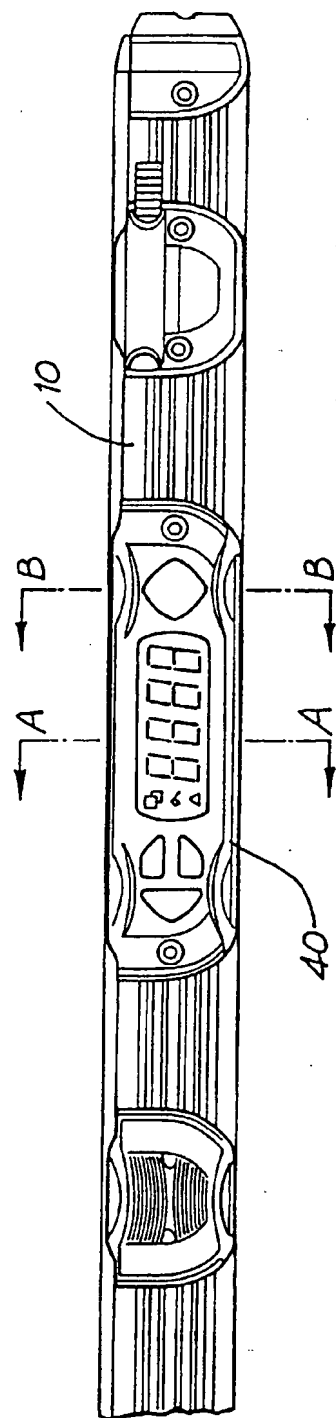


FIG. 15(a)

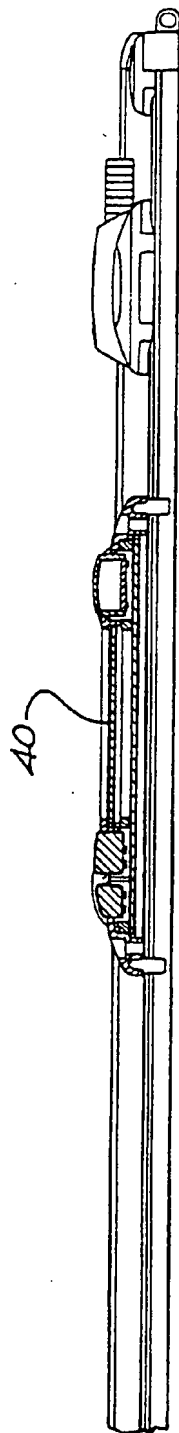


FIG. 15(b)

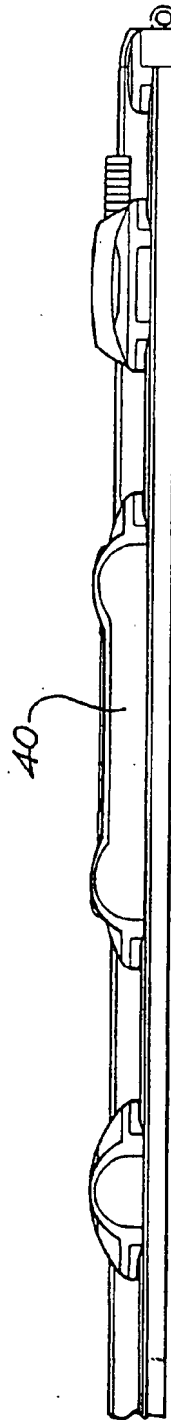


FIG. 15(c)

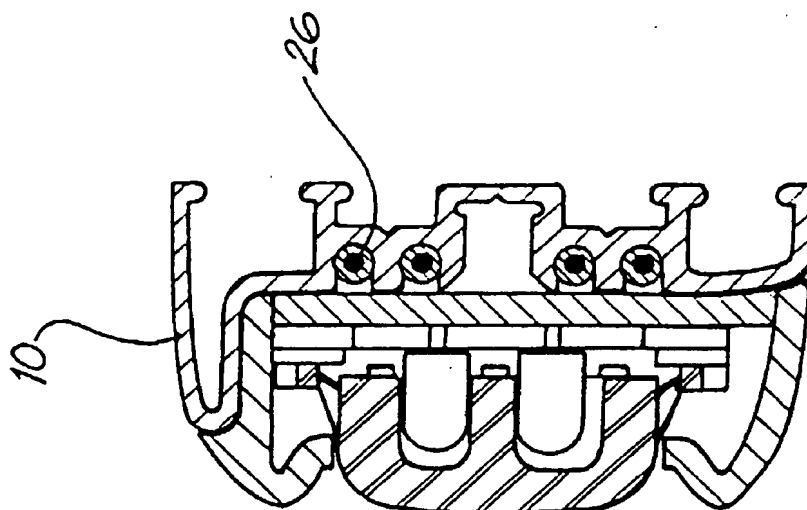


FIG. 15(e)

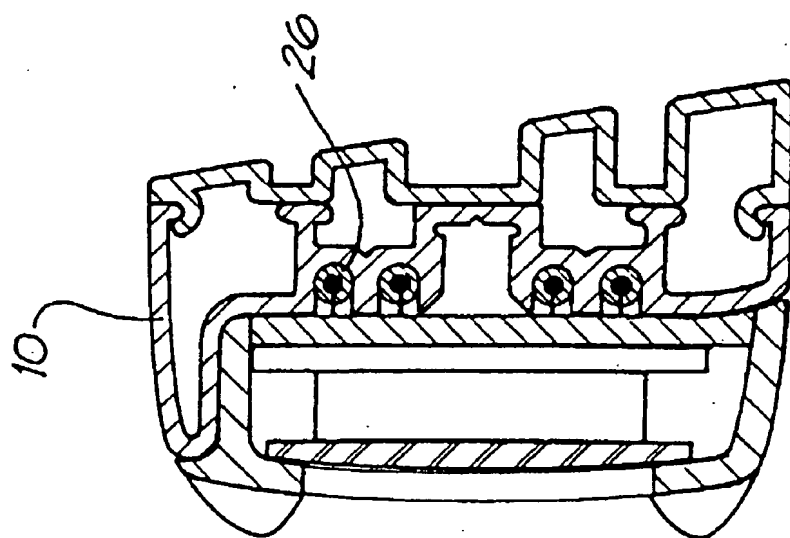
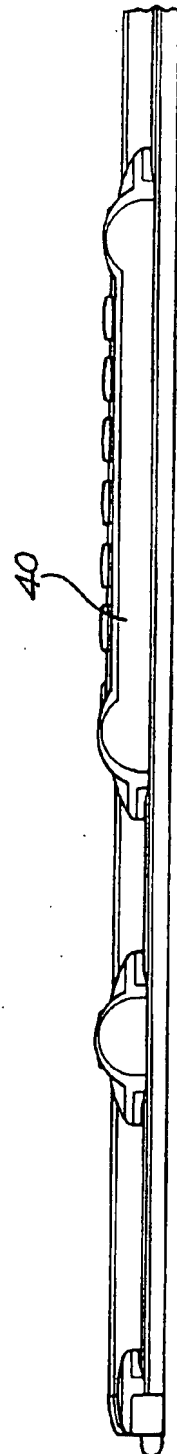
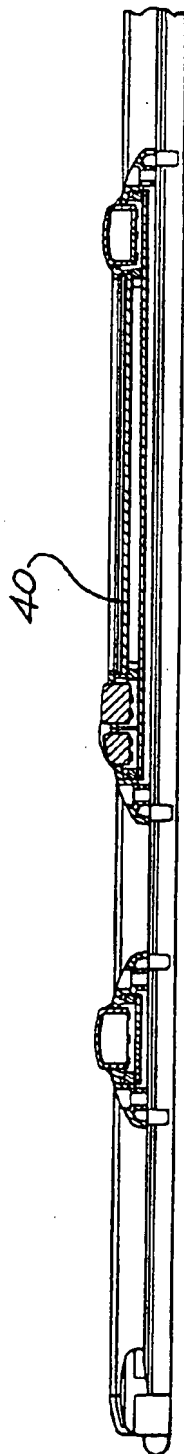
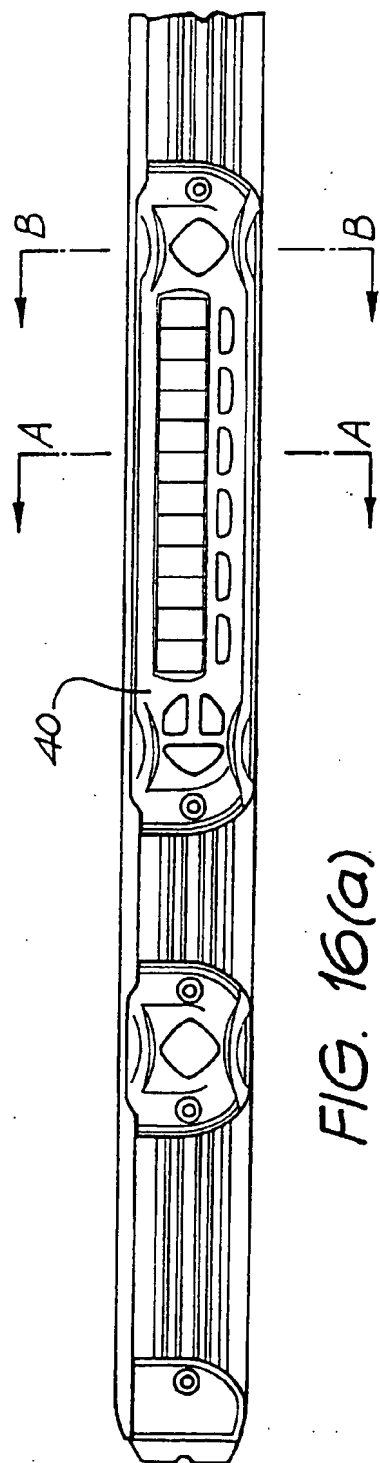
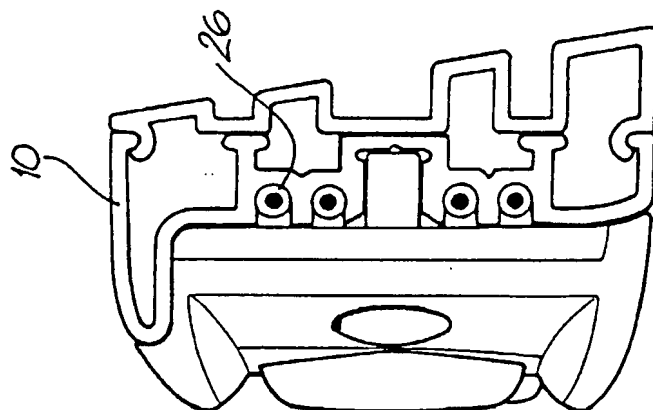
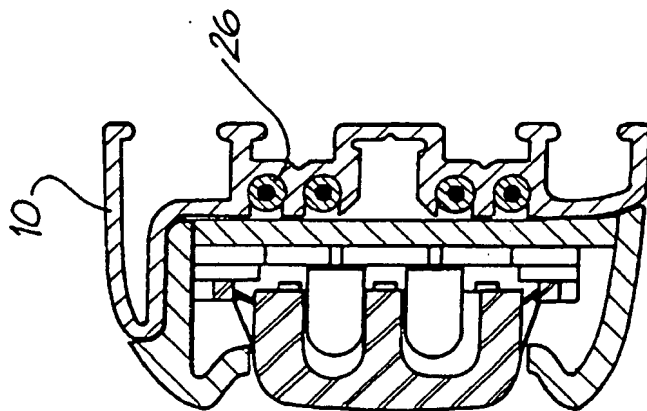
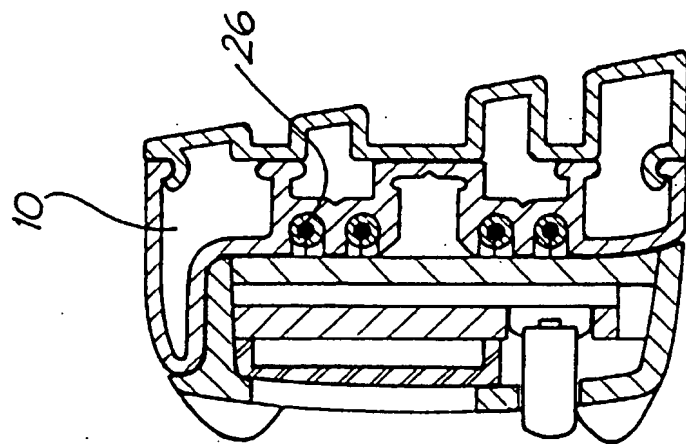


FIG. 15(d)





PAPERLESS PICKING SYSTEM

FIELD OF THE INVENTION

[0001] This invention pertains to picking systems and more particularly to a paperless, order assembly system.

BACKGROUND OF THE INVENTION

[0002] Distribution centres typically utilise order picking systems for the purpose of assembling their customer's orders. In modern distribution centres, order picking has been made paperless, at least to the person manually picking orders. A modern paperless picking system has numerous advantages; it allows the picker to use both hands, is more accurate, tracks productivity and generates reports, maintains products statistic, offers accountability and improves inventory management. Prior art paperless picking systems may, for example, revolve around a central system controller (computer) which interfaces with a customer's host computer, one or more monitors and a series of "second level devices" or section controllers which manage picking zone level activities. The section controllers in turn, control picking bay level and picking slot or location level devices. Each pick location or slot is identified by one of a family of devices which are positioned throughout the picking area giving order information to the pickers and providing an interface for peripheral devices such as scanners. Zone level information is transmitted to the picker and received from the picker by any number of electronic devices.

[0003] Zone and location level devices are generally capable of displaying pick data, acquiring pick confirmation data, displaying quantity adjustment and quantity recall, or other functions which may be relevant to the order picking job at hand. In addition, each pick zone including multiple bays of case flow racks, pallet racks or shelving may be associated with a zone panel. The zone panel in prior art systems is located in each zone and displays order numbers, number of picks, scrolled messages and other textual information. The zone panel may also provide access to diagnostic functions and serves as a back up to the slot displays. Pickers can adjust their routes according to directions from the zone panel display.

[0004] Paperless order assembly systems of the type described above are popular in modern distribution centres. However, the hardware and hardware installation associated with paperless picking systems can be improved. Individual slot level devices are centrally networked together and hence repositioning of a slot device requires a rewiring of that portion of the network to which the relocated slot level device belongs. Further, the network cabling extending between slot level devices must be shielded, requiring a certain degree of customisation for every slot level device installed or relocated. Thus the job of installing or relocating the slot level devices is both time-consuming and expensive.

OBJECT OF THE INVENTION

[0005] It is an object of the present invention to provide a paperless order assembly system and apparatus therefor which facilitates installation and reconfiguration, or at least provides a viable alternative to existing paperless systems.

SUMMARY OF THE INVENTION

[0006] Accordingly, a first aspect of the present invention provides an elongate support rail and a location or zone level

data device, the support rail having a plurality of longitudinally extending spaced apart channels formed therein, each channel defining an opening into which may be inserted one or more lengths of insulated conducting wire, the location or zone level data device attachable to a front face of the rail, the device having a plurality of penetrating pins corresponding generally in lateral spacing to the channels in the support rail, the pins being adapted to penetrate the insulation of the wire with the device in an operational position, thereby to provide an electrical connection between the device and the wire at selected locations on the support rail.

[0007] A further aspect of the present invention provides a paperless picking system including an elongate support rail having a plurality of longitudinally extending spaced apart channels formed therein, each channel defining an opening into which may be inserted one or more lengths of insulated conducting wire, a location or zone level data device attachable to a front face of the rail, the device having a plurality of penetrating pins corresponding generally in lateral spacing to the channels in the support rail, the pins being adapted to penetrate the insulation of the wire with the device in an operational position, thereby to provide an electrical connection between the device and the wire at selected locations on the support rail.

[0008] A yet further aspect of the present invention provides an elongate support rail for use in a paperless picking system, said support rail having a plurality of longitudinally extending spaced apart channels formed therein, each channel defining an opening into which may be inserted one or more lengths of insulated conducting wire, said support rail adapted to receive a location or zone level data device on a front face of the rail, the device having a plurality of penetrating pins corresponding generally in lateral spacing to the channels in the support rail, the pins being adapted to penetrate the insulation of the wire with the device in an operational position, thereby to provide an electrical connection between the device and the wire at selected locations on the support rail.

[0009] A yet further aspect of the present invention provides a location or zone level data device for a paperless picking system, said device adapted to be attachable to a front face of an elongate support rail having a plurality of longitudinally extending spaced apart channels formed therein, each channel defining an opening into which may be inserted one or more lengths of insulated conducting wire, said device having a plurality of penetrating pins corresponding generally in lateral spacing to the channels in the support rail, the pins being adapted to penetrate the insulation of the wire with the device in an operational position, thereby to provide an electrical connection between the device and the wire at selected locations on the support rail.

[0010] In a preferred embodiment, the devices are configured so as to resist inverted positioning with respect to the rail. In another preferred embodiment, the number of penetrating pins on the device is at least twice the number of channels in the rail. The insulation is preferably self-healing and the wire is preferably multi-stranded.

[0011] The present invention has particular application in relation to paperless, light-directed order assembly systems which utilise distributed control architecture.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

[0013] FIG. 1 is a cross-sectional view of a support rail according to the present invention affixed to an adaptor;

[0014] FIG. 2 is a cross-sectional view of the device depicted in FIG. 1 when attached to a spacer;

[0015] FIG. 3 is an invertible 45° angle adaptor fitted with a support rail according to the present invention;

[0016] FIG. 4 is a cross sectional view of a device with penetrating pins and a support rail according to the present invention, the device being in a proper position for installation;

[0017] FIG. 5 is a cross-sectional exploded view of a device and rail, where the device is inverted;

[0018] FIG. 6 illustrates an inverted device positioned over a rail, where proper installation is thwarted;

[0019] FIG. 7 illustrates the arrangement depicted in FIG. 6, further illustrating that the pins will not penetrate the insulation when the device is inverted;

[0020] FIG. 8 is a front view of an integrated location level device for deployment at a pick location;

[0021] FIG. 9 is a bottom view of the device shown in FIG. 8;

[0022] FIG. 10 is a side view of the device shown in FIG. 8;

[0023] FIGS. 11(a) and (b) are front and bottom views of a zone indicator device;

[0024] FIGS. 12(a) and (b) are front and bottom views of a multi-function bay controller device;

[0025] FIGS. 13(a) and (b) are top and side views of a split drive device;

[0026] FIG. 14 is a front view of a pick light device;

[0027] FIG. 15(a) is a front view of a further preferred embodiment of the support rail and data device according to the present invention;

[0028] FIG. 15(b) is a bottom view of the support rail and data device shown in FIG. 15(a);

[0029] FIG. 15(c) is a top view of the support rail and data device shown in FIG. 15(a);

[0030] FIG. 15(d) is a cross-sectional view of the support rail and data device taken through plane AA in FIG. 15(a);

[0031] FIG. 15(e) is a cross-sectional view of the support rail and data device taken through plane BB in FIG. 15(a);

[0032] FIG. 16(a) is a front view of a further preferred embodiment of the support rail and data device according to the present invention;

[0033] FIG. 16(b) is a bottom view of the support rail and data device shown in FIG. 16(a);

[0034] FIG. 16(c) is a top view of the support rail and data device shown in FIG. 16(a);

[0035] FIG. 16(d) is a cross-sectional view of the support rail and data device shown in FIG. 16(a) taken through plane AA in FIG. 16(a);

[0036] FIG. 16(e) is a cross-sectional view of the support rail and data device shown in FIG. 16(a) taken through plane BB in FIG. 16(a); and

[0037] FIG. 16(f) is a side view of the support rail and data device depicted in FIG. 16(a).

PREFERRED EMBODIMENTS OF THE INVENTION

[0038] The following disclosure pertains to a physical data and power network which includes a convenient way of fastening and connecting physical devices which operate by means of this network. The broad means of physical and electrical connection of the devices to the network is essentially common to all of the devices in this disclosure, which are provided as examples of a family of such devices.

[0039] Modern distribution centres utilise a network of electronic devices for managing order picking operations. Human pickers are guided to zones, bays and individual locations for picking, by light emitting devices. These same devices can provide the pickers with valuable data and collect data from the pickers. The devices, the cabling interconnecting the devices and the computers that manage and record data etc., form a paperless picking system network. Electrically, the devices and the computer(s) are connected together by copper wire. The present invention strives to reduce the number of discontinuities or interruptions in the copper wire component of the network. At the same time, this approach provides flexibility and ease of use and maintenance.

[0040] As shown in FIG. 1, a rail section 10 for a paperless picking system comprises an extruded aluminium rail 11. The rail 11 includes a front surface 12 preferably including four channels 13. Each channel 13 is adapted to snugly receive a length of insulated, "self-healing" multi-strand copper wire. The insulated multi-strand wire is for example, "Silivolt-E" brand cable from Isola Breitenbach. From the cross-sectional view of FIG. 1 it will be appreciated that the rail is not symmetrical about its longitudinal centre line 14. In this particular example, this asymmetry is manifested as an upper edge 15 which is radiused to a greater degree than the lower edge 16. Internal webs 17 serve to position the rail with respect to a support bracket 18. The support bracket 18 facilitates the attachment of the rail to, for example, a length of shelving 19. The bracket 18 may include upper and lower flanged edges 20, 21. Specially adapted rear edges 22, 23 of the rail are capable of resiliently engaging and retaining the rail on the bracket. To install a rail, the rear upper edge may be first inserted up and over the upper flanged edge 20 of the bracket. Then, the lower rear edge 23 of the rail is pushed over the lower flanged edge 21 of the bracket. As the lower edge 23 of the rail 10 is resiliently deformable and includes an inner ramped surface 24, the edge 23 slides up and over the flange 21. Retained by the edges 22, 23, the bracket is urged into position against the internal web 17 for a snug and secure fit.

[0041] FIG. 2 illustrates that a spacer 25 may be required in order to compensate for a portion of a shelf etc., which forms a gap with respect to the bracket 18. In some instances

it may be preferred to have an insulating spacer 25 so that in conjunction with an insulating bracket 18 the metallic rail 10 maintains electrical contact with the shelf 19. Note that the rear extremities of the rail 10 provide edges 22a, 23a which are used to retain any number of individual devices as will be explained below.

[0042] FIG. 3 illustrates a mounting bracket 30 which includes an inclined surface 31 for mounting the rail 10. The bracket 31 includes the same flanged edges 20, 21 as seen in the devices depicted in FIGS. 1 and 2. It will be appreciated that the bracket 30 may be inverted so that the rail 10 may be presented to the user either facing upwardly or downwardly.

[0043] In practice, the rail 10 as depicted in FIGS. 1-3 is provided in 2 metre lengths which are convenient for shipping. However, the shelving or bays to which the rails are fitted are often considerably longer. For this reason, mechanical connectors are provided which allow individual extruded rail segments 11 to be mechanically joined. Once rail segments are joined into a length they are ready to accept the insulated wire 26 which is retained by slight interference or friction between the wire 26 and the channel 13. The purpose of this rail 10, channel 13 and wire 26 arrangement is to accept a mechanical and electrical inter-connection with any of a variety of modular zone level devices, bay level devices or location level devices.

[0044] It has been observed that the combination of aluminium rail and wire depicted above actually provides better electronic shielding than prior art devices even though the wire 26 is not fully concealed by the rail 10.

[0045] As shown in FIG. 4, a typical location level device 40 comprises a channel-like body 41 which fits over and clamps snugly onto the rail 10. Upper and lower jaws 70, 71 of the device 40 allow the sides to open slightly as it rides up and over the rail 10, thereafter closing to positively engage or clamp the device with respect to rail 10. Ramped surfaces 42, 43 define teeth 42a, 43a for retaining the device in position.

[0046] Within the channel-like body 41 there is located at least one vertical row of penetrating pins 45, with the pin spacing corresponding to the wire spacing. Preferably the number of pins is at least equal in number to the number of channels in the support rail. When the device 40 is installed correctly on the rail 10, each of the individual pins 46 penetrates the insulation of a wire 26 and makes electrical contact with a multi stranded core. Two or more vertical rows of spaced pins 46 may be provided allowing a certain degree of redundancy in the electrical connection to the rail.

[0047] In a preferred embodiment, the order of the four wires from top to bottom, is, for example, power, data in, data out and ground. It will therefore be appreciated that it is important that the device 40 not be capable of installation in an inverted position. This would have the effect of at least rendering the device 40 inoperative, if not damaging or destroying it.

[0048] Inverted installation of the device is prevented by having the interior 50 of the device 40 conform to the external shape of the rail 10. An interior web or wall section 51 is shaped to conform to the radiused upper edge 15 of the rail 10. Thus, as depicted in FIGS. 5-7 while it might be physically possible to place the device 40 partially over the

rail 10, it is not possible to force the pins 46 into electrical contact with the wires 26. FIG. 6 illustrates maximum insertion along the bottom of the rail 10 and FIG. 7 illustrates a forcing along the topside of the rail. Because of the interference between the radius internal wall or web 51 and the bottom edge 16 of the rail 10, along with other factors such as the rigidity of the channel-like body 41 it is simply not possible to force the pins 46 into electrical contact when the device 40 is inverted.

[0049] As shown in FIG. 8, a location level device 60 may incorporate numerous functions including alpha numeric display 61, auxiliary indicators 62, data input button 63 and location indicators 64. This multi function location level device fits over the rail 10, only in the correct orientation as suggested by FIGS. 4-7. In preferred embodiments, and as shown in FIG. 9, the device 60 includes one or two pairs of resilient security jaws 70, 71. A single pair of jaws 70 or 71 is adapted to be grasped by one hand of the person installing the device 60. Each pair of jaws 70, 71 (shown in FIG. 10) is biased into a closed or clamped position whereby retaining teeth 72 may engage rear surfaces 22a, 23a (see FIG. 2) of the rail and prevent the device 60 from accidental disengagement with the rail 10. The ramped surfaces 73 ride over the surface of the rail until the internal penetrating pins 74 pierce the insulation on the wires 26 and make electrical contact with the copper wire network. Because of the asymmetrical interior surface 51, the device 60 cannot be installed in an inverted position. To remove the device depicted in FIGS. 8-10, the device 60 must be gripped by both hands. Ideally, the user's left hand grips the left hand pair of jaws 70 while the right hand grips the right hand jaws 71. Pressure on both pairs of jaws 70, 71 simultaneously causes the teeth to separate in the direction of the arrows 75, thus removing any impediment to the removal of the device 60. Note that the device shown in side elevation in FIG. 10 only suggests four pins 74, one each dedicated to power input, data input, data output, and ground. A device of this size may be equipped with two or more vertical, parallel and similar rows of teeth 74 to provide or secure electrical contact, redundancy in the advent of failure and therefore extended operational life.

[0050] As shown in FIG. 11, a zone indicator of light 80 comprises a front panel 81 through which are visible light emitting display devices such as LEDs, LCDs, back-lit LCDs etc. The device receives data through an arrangement of pins (see FIG. 10) and displays data in the form of patterns, shapes or colours which indicate a particular zone for a worker to pick in. The device may incorporate a single pair of resilient jaws 82 for further securing the attachment of the device 80 to the rail 10.

[0051] FIGS. 12(a) and (b) illustrates a considerably more sophisticated display and data input device 85 which incorporates many features normally associated with bay level device into a location level device. The device is capable of allowing an operator to input data as well as displaying a wide variety of data to the operator or picker. A large alpha-numeric display 86 facilitates the interaction and data exchange between the paperless picking system and the picker. Note that two pairs of resilient jaws 87, 88 are provided to prevent inadvertent disengagement of the device from the rail.

[0052] FIGS. 13(a) and (b) illustrate a device known as a split drive 90. The split drive is installed onto the rail 10 and

includes a pair of resilient jaws 91. The split drive includes internal electronic components which allow the power and data from one source to be split so as to drive to different receiving objects. The device 90 can receive power and data through penetrating pins from the wires in a rail (see FIG. 10) onto which it is mounted. It can transmit data and power to one or two different rails or other split drives. Wires which enter or exit the split drive 90 may pass through output sleeves 92 conveniently located on the front of the device. In the alternative, a device can receive a power and data input through external wires entering through one of the sleeves 92, in which case the device then delivers this information and power to both the rail 10 on which it is fixed (via penetrating pins) and another split drive device or rail. In essence the split drive is a self configuring "T" connector for the network.

[0053] FIG. 14 displays a simple location level picking device 95 which includes a flashing indicator button 96. The device affixes to the rail in the same way as the other devices in this family (see FIG. 10) and also includes a single set of resilient jaws 97 for preventing inadvertent disconnection from the rail.

[0054] FIGS. 15(a) to 15(e) and FIGS. 16(a) to 16(f) depict various views of further alternative embodiments of the present invention. For ease of reference, those features in common with the other embodiments of the invention previously discussed have been given the same reference numerals.

[0055] In the preferred embodiments of FIGS. 15(a) to 15(c) and FIGS. 16(a) to 16(f), it should be noted that the support rail includes an upper surface which extends outwardly from the body of the rail. Additionally, the upper surface of the rail and the upper portion of the device are radiused. In this way, a degree of shielding and protection is provided to the device. This form of the invention is particularly preferable in applications where the support rail and device may be prone to being struck by, for example, objects falling from shelves above the rail.

[0056] While the aforementioned devices have been disclosed with reference to particular details of construction, this should be understood as having been provided by way of example only and not as limitations to the scope and spirit of the invention. The specific examples provided here regarding rail asymmetry and non-invertible coupling with devices should be seen as an example of asymmetrical rail design. Further, the specific functions performed by the family of devices disclosed here should also not be seen as a limitation to the scope of the family of such devices as may be employed in such a picking system.

1. A paperless picking system including an elongate support rail having a plurality of longitudinally extending spaced apart channels formed therein, each channel defining an opening into which may be inserted one or more lengths of insulated conducting wire, a location or zone level data device attachable to a front face of the rail, the device having a plurality of penetrating pins corresponding generally in lateral spacing to the channels in the support rail, the pins being adapted to penetrate the insulation of the wire with the device in an operational position, thereby to provide an electrical connection between the device and the wire at selected locations on the support rail.

2. A paperless picking system as claimed in claim 1 wherein said device is configured so as to resist inverted positioning with respect to the rail.

3. A paperless picking system as claimed in claim 1 wherein the number of penetrating pins on the device is at least twice the number of channels in the rail.

4. A paperless picking system as claimed in claim 1 wherein the insulation is self-healing.

5. A paperless picking system as claimed in claim 1 wherein said support rail is formed from extruded aluminium.

6. A paperless picking system as claimed in claim 1 wherein said support rail includes at least four of said channels.

7. A paperless picking system as claimed in claim 1 wherein said support rail is adapted to resiliently engage with a mounting bracket.

8. A paperless picking system as claimed in claim 1 wherein said support rail includes a curved upper surface.

9. A paperless picking system as claimed in claim 1 wherein the number of penetrating pins of the device is at least equal in number to the number of channels in the support rail.

10. An elongate support rail and a location or zone level data device for use in a paperless picking system, said support rail having a plurality of longitudinally extending spaced apart channels formed therein, each channel defining an opening into which may be inserted one or more lengths of insulated conducting wire, the location or zone level data device being attachable to a front face of the rail, the device having a plurality of penetrating pins corresponding generally in lateral spacing to the channels in the support rail, the pins being adapted to penetrate the insulation of the wire with the device in an operational position, thereby to provide an electrical connection between the device and the wire at selected locations on the support rail.

11. An elongate support rail and a location or zone level data device as claimed in claim 10 wherein said device is configured so as to resist inverted positioning with respect to the rail.

12. An elongate support rail and a location or zone level data device as claimed in claim 10 wherein the number of penetrating pins on the device is at least twice the number of channels in the rail.

13. An elongate support rail and a location or zone level data device as claimed in claim 10 wherein said support rail is formed from extruded aluminium.

14. An elongate support rail and a location or zone level data device as claimed in claim 10 wherein said support rail includes at least four of said channels.

15. An elongate support rail and a location or zone level data device as claimed in claim 10 wherein said support rail is adapted to resiliently engage with a mounting bracket.

16. An elongate support rail and a location or zone level data device as claimed in claim 10 wherein said support rail includes a curved upper surface.

17. An elongate support rail for use in a paperless picking system, said support rail having a plurality of longitudinally extending spaced apart channels formed therein, each channel defining an opening into which may be inserted one or more lengths of insulated conducting wire, said support rail adapted to receive a location or zone level data device on a front face of the rail, the device having a plurality of penetrating pins corresponding generally in lateral spacing

to the channels in the support rail, the pins being adapted to penetrate the insulation of the wire with the device in an operational position, thereby to provide an electrical connection between the device and the wire at selected locations on the support rail.

18. An elongate support rail as claimed in claim 17 wherein said support rail is formed from extruded aluminium.

19. An elongate support rail as claimed in claim 17 wherein said support rail includes at least four of said channels.

20. An elongate support rail as claimed in claim 17 wherein said support rail is adapted to resiliently engage with a mounting bracket.

21. An elongate support rail as claimed in claim 17 wherein said support rail includes a curved upper surface.

22. A location or zone level data device for use in a paperless picking system, said device adapted to be attachable to a front face of an elongate support rail having a

plurality of longitudinally extending spaced apart channels formed therein, each channel defining an opening into which may be inserted one or more lengths of insulated conducting wire, said device having a plurality of penetrating pins corresponding generally in lateral spacing to the channels in the support rail, the pins being adapted to penetrate the insulation of the wire with the device in an operational position thereby to provide an electrical connection between the device and the wire at selected locations on the support rail.

23. A paperless picking system as claimed in claim 22 wherein said device is configured so as to resist inverted positioning with respect to the rail.

24. A paperless picking system as claimed in claim 22 wherein the number of penetrating pins of the device is at least equal in number to the number of channels in the support rail.

* * * * *



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Gossmann

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(54) **CONTACTING DEVICE FOR A FLAT BAND CABLE**

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(52) U.S. Cl. **439/411; 439/425**

(58) Field of Search **439/492, 495, 439/497, 411, 426, 404, 417, 425**

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(57) **ABSTRACT**

In order to achieve a high degree of protection, especially a degree of protection IP67 with the simplest possible sealing system in contacting device, a sealing ridge is provided on housing top, which cooperates with a gasket. For reliable sealing, this is preferably arranged continuously around a contact region and is forced into the preferably plate-like gasket in the installed state. During contacting of the conductors of ribbon cable, a contacting element, for example, of contact screw penetrates the gasket and in so doing displaces sealing material, which additionally contributes to sealing. The contacting device is preferably designed as an adapter for a field bus system or as a so-called "heavy rectangular plug-in connector".

15 Claims, 4 Drawing Sheets

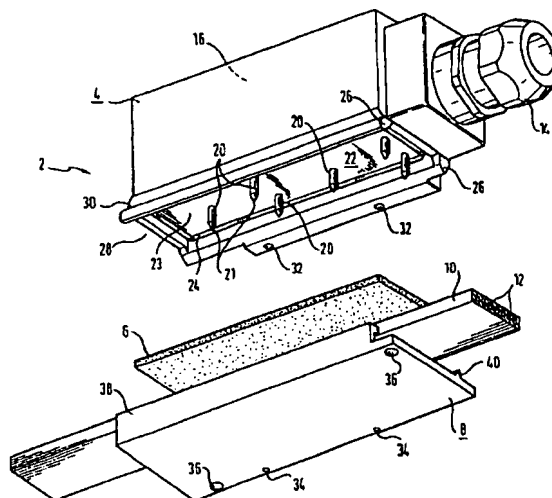


EXHIBIT B

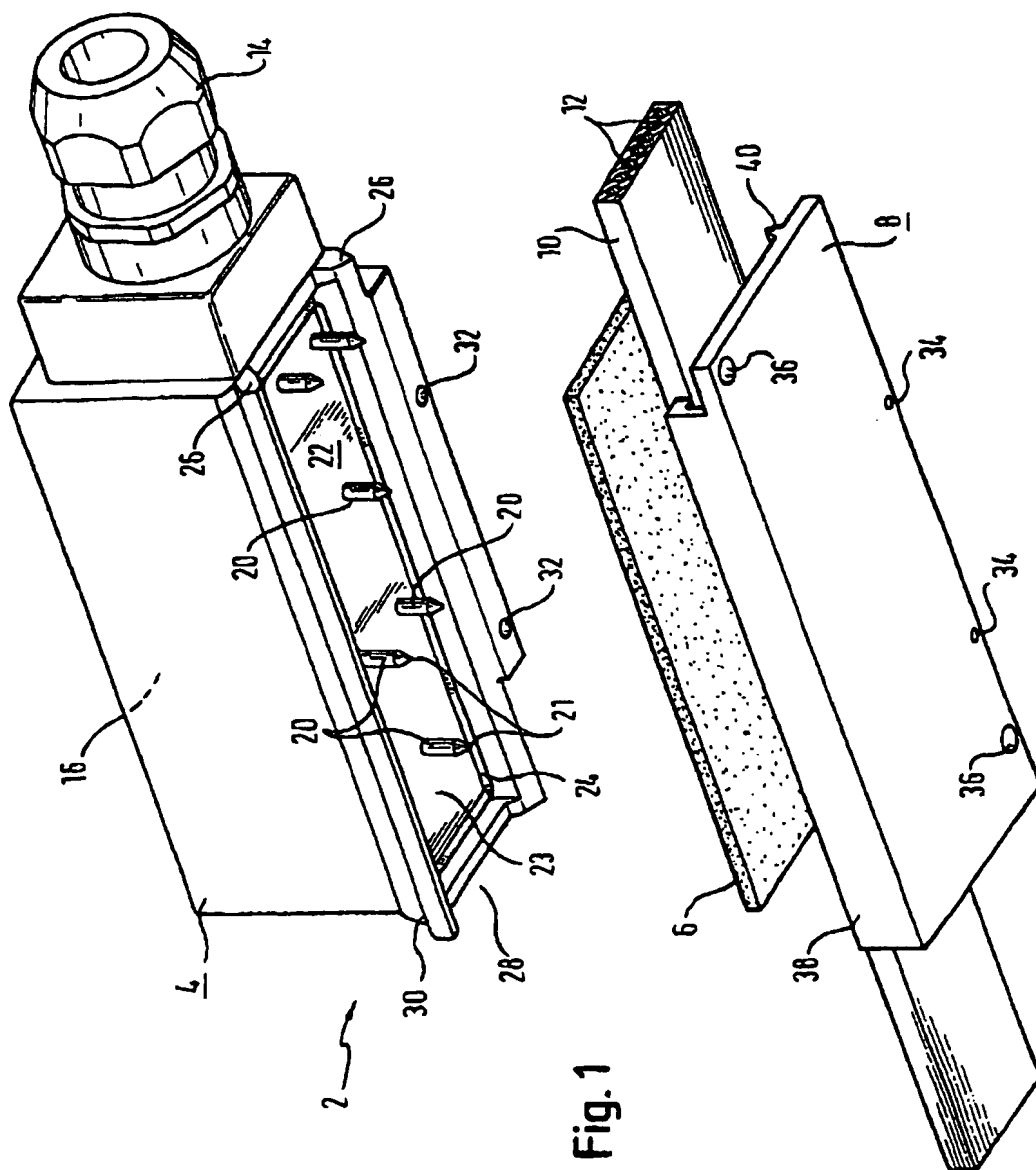
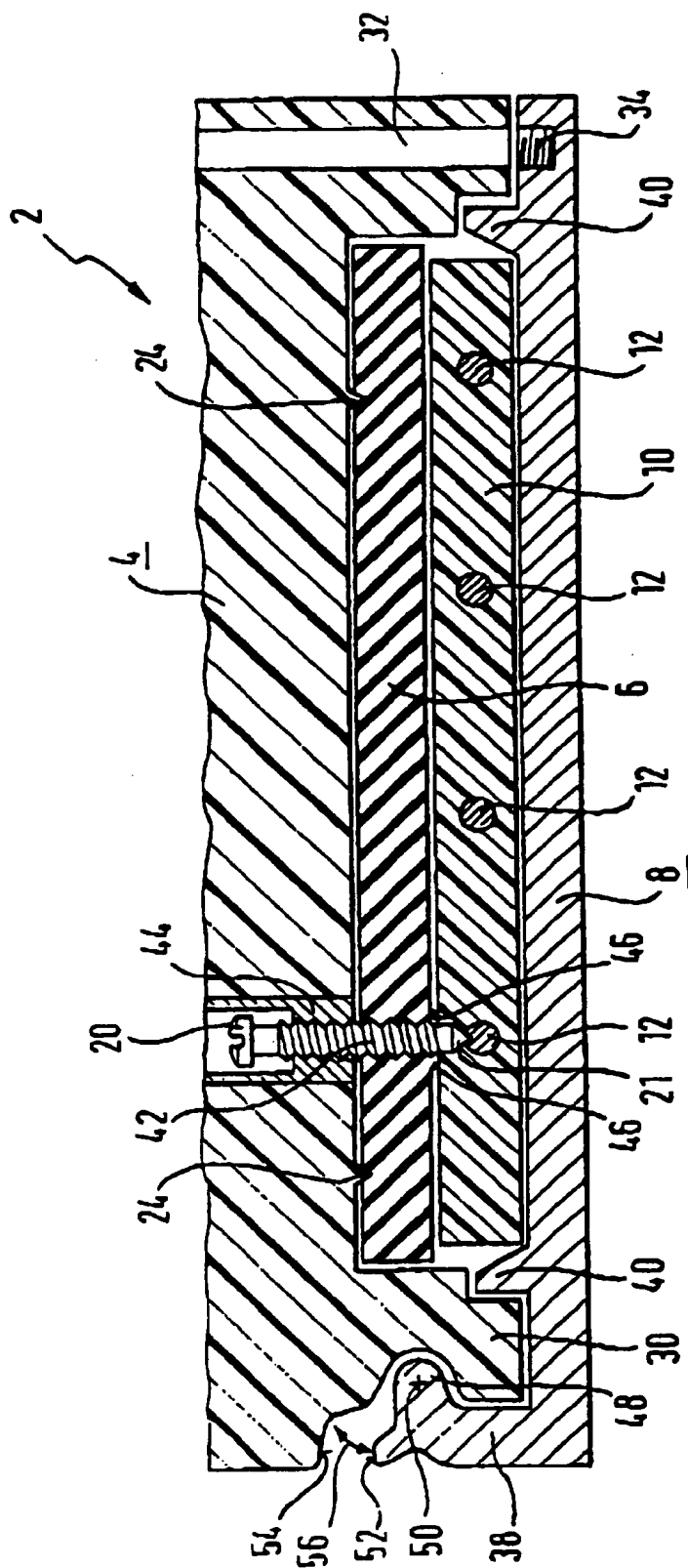


Fig. 2



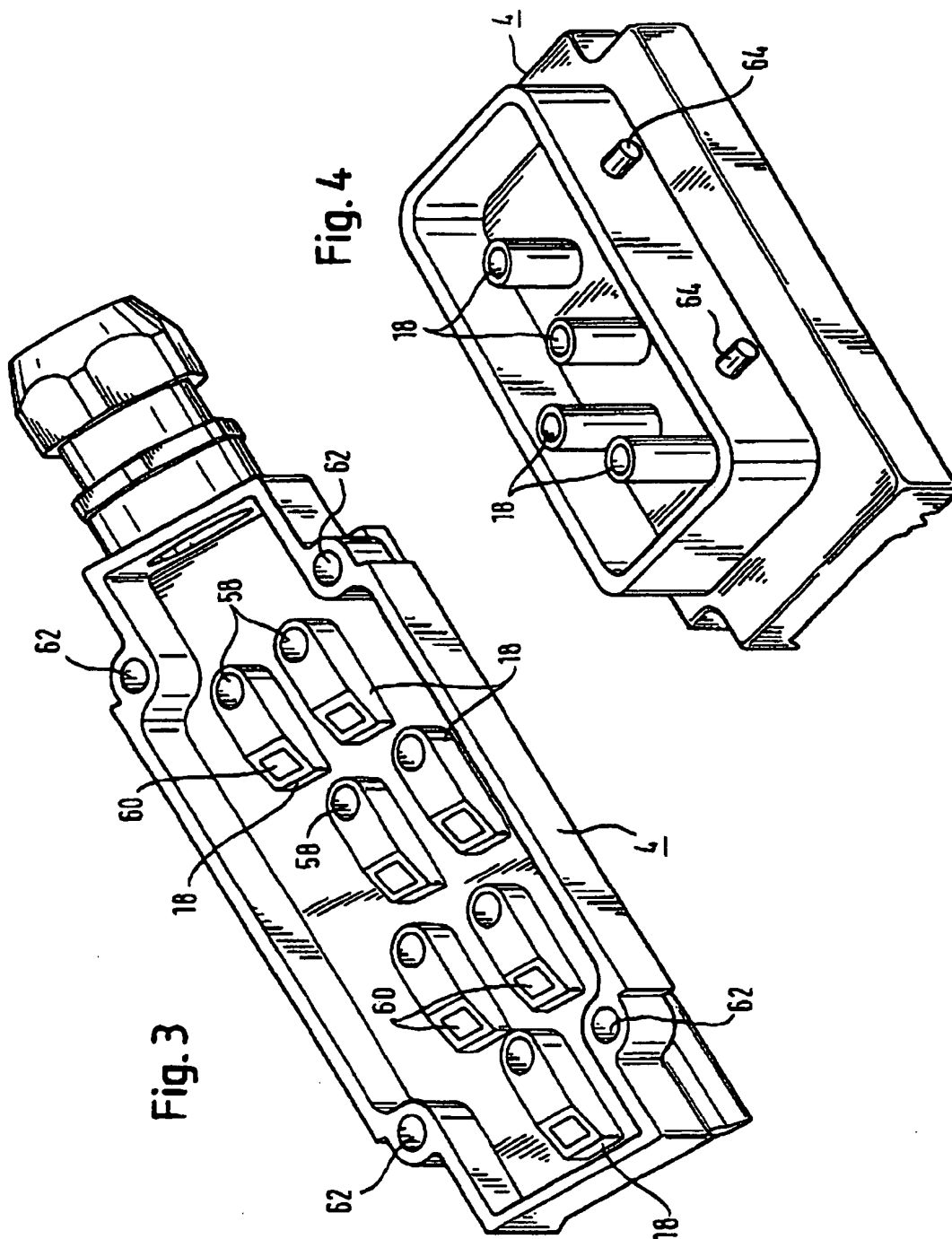
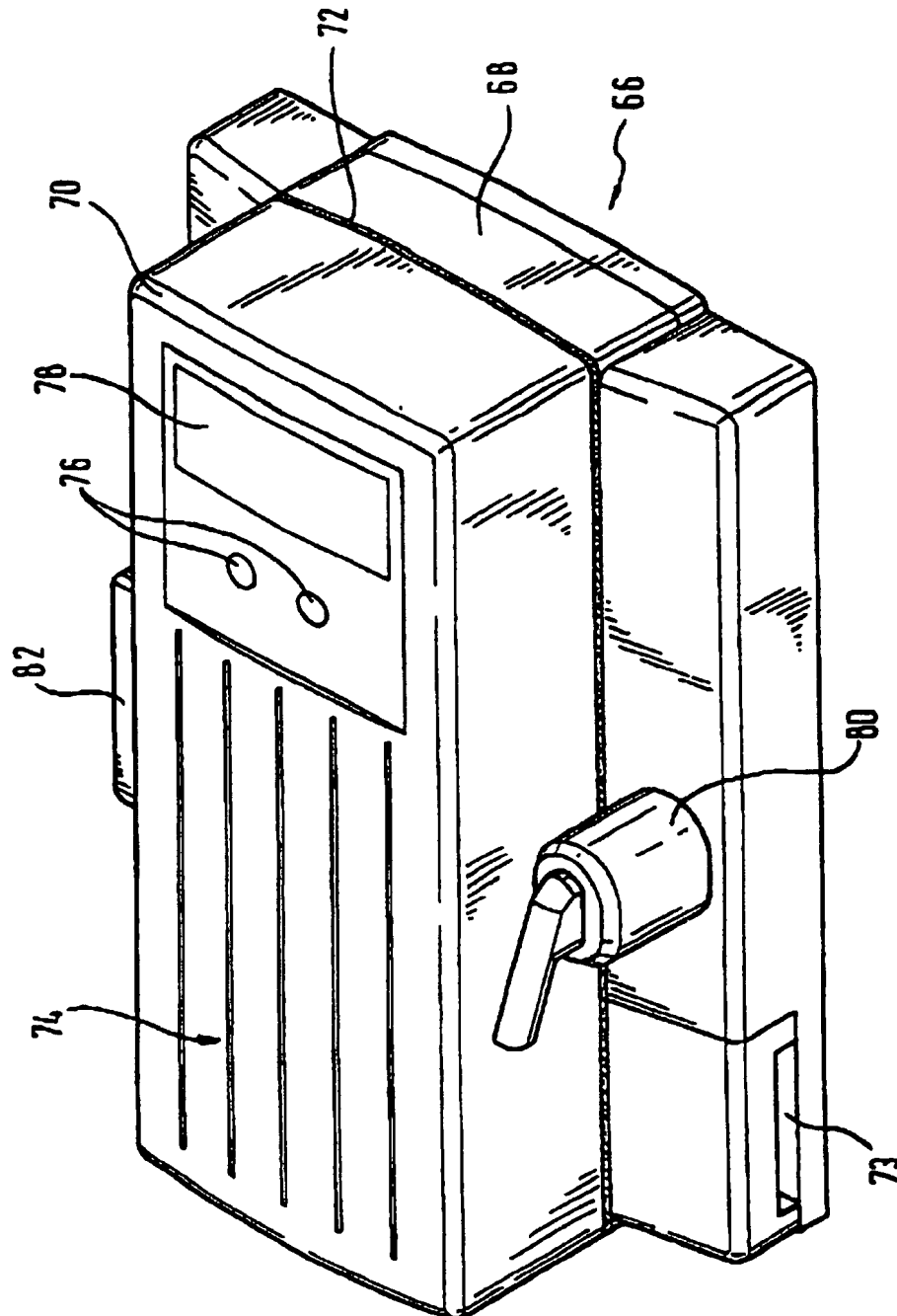


Fig. 5



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CONTACTING DEVICE FOR A FLAT BAND
CABLE

FIELD OF INVENTION

The invention concerns a contacting device for a ribbon cable with a housing top enclosing a number of contacting elements and with a housing bottom, between which the ribbon cable can be passed, a gasket being provided that seals the housing top against the ribbon cable when it is installed.

BACKGROUND OF THE INVENTION

Ribbon cables are used in a number of areas, for example, in building technology, in the automotive sector or in industrial control and automation technology. They are used both for electrical power supply in the low voltage range, for example, for an electrical system in a vehicle, and also in the ordinary voltage range of a few 100 V for building installation. The ribbon cables have several electrical conductors arranged next to each other, some of which can be used for power supply and some as communications lines.

It is often desirable, especially in building technology and in industrial control and automation technology, to arrange electrical equipment in a spatially flexible manner and to connect it without laying costly installation lines. A ribbon cable laid through the room is particularly suited for this purpose, via which power and communication supply for the connected equipment can occur. The equipment can be connected to the ribbon cable at any location in the room via contacting devices. Both power supply and communication of equipment with each other or with a central office is therefore achieved via ribbon cables. A bus system (field bus) is preferably provided for this. The bus system can be designed as a power bus and/or data bus. In this case the contacting device is designed as a bus adapter, via which the equipment can be connected to the bus system. This type of electrical installation system designed as a bus system is known from EP 0 665 608 A2.

The contacting device is primarily prescribed for those applications in which the conductors of an ordinary ground cable are to be contacted with those of a ribbon cable. A known technique for contacting is so-called penetration contacting in which the contact pins penetrate the covering of the ribbon cable and the insulation of the conductors being contacted. For reliable and permanent contacting, the contact region must be protected from penetration of dirt and water. Different degrees of protection are established by European Standard EN 60 529. The degree of protection IP67 is sought for contacting equipment.

A contacting device of the type just mentioned is known from DE 196 18 998 C1. To achieve a high degree of protection, a sealing element is provided between the ribbon cable and the housing top. This consists essentially of connected O rings. The contact pins or contacting elements are passed through the openings of the O rings and penetrate into the ribbon cable. The sealing element additionally has an elevation on its outer edge in the form of a spring that engages in a correspondingly shaped groove in the housing top. Sealing is obtained via the O rings between the ribbon cable and sealing element and the housing top is obtained via the groove-spring configuration. A shortcoming in this variant is the complex configuration of the sealing element and the fact that fitting into the groove of the housing top must occur.

OVERVIEW

The underlying task of the present invention is to offer a contacting device with a simply configured sealing system that guarantees a high degree of protection.

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According to it a sealing ridge is provided on the housing top that cooperates with the gasket. Sealing between the gasket and housing top then occurs so that the gasket is pressed against the sealing ridge during assembly. Because of this, reliable sealing is achieved. At the same time the need for a demanding groove-spring configuration drops out, since the gasket need not have a groove in the region of the sealing ridge.

The sealing ridge in a preferred variant is molded directly onto the housing top. It is therefore an integral component of the housing top, which is designed in particular as an injection molded part. This facilitates manufacture.

To achieve the highest possible tightness, the sealing ridge in an advantageous embodiment is arranged continuously around a contacting region in which the contacting elements are situated.

Preferably the sealing ridge tapers to a point in the direction toward the gasket so that the sealing ridge in the installed state presses into the gasket and high sealing is achieved. For example, the sealing ridge is designed to be triangular when viewed in cross section for this purpose. For a simple configuration of the gasket, it is preferably designed to be flat. The gasket is therefore a flat seal and, for example, a rubber strip.

The gasket is preferably designed essentially to be continuous, i.e., has no recesses especially in the region of the contacting elements. This applies at least for the uninstalled state. This has the advantage of extremely simple configuration of the gasket.

The continuous gasket also favors reliable sealing between the gasket and ribbon cable when the contacting element is traversed by the gasket during assembly. The contacting element then displaces the sealing material, which is closely conformed around the contacting element, on the one hand, and forms a small bulge toward the ribbon cable on the bottom of the gasket, on the other hand, which almost has the effect of an O ring. In preferred variants, the contacting elements are guided through the gasket in the installed state, which lie tight against the contacting elements. The contacting elements are then preferably guided through the gasket, the sealing material displaced by the contacting elements forming a continuous bulge around the corresponding contacting element which serves for sealing of the ribbon cable to the corresponding contacting elements. This sealing can be achieved regardless of the sealing obtained via the sealing ridge.

The contacting elements preferably have screws for screwing into the ribbon cables. Contact with the conductors of the ribbon cable is therefore produced via the screws. In contrast to simply designed contacting pins, the screws have the advantage that greater forces can be exerted with them. They are particularly suited for relatively strongly designed ribbon cables. In addition, the penetration depth into the ribbon cable can be adjusted with the screws.

For rapid and simple assembly, the housing bottom preferably has a guide rail into which the housing top can be inserted by means of a guide element. The guide rail is designed for this purpose as a simple profile rail, for example.

The guide rail and guide element then preferably cooperate in the fashion of a hinge. A clearance is set for this purpose preferably between the guide rail and guide element so that swiveling of the two housing parts around a pivot axis formed by the guide rail and guide element is possible. This permits simple assembly of the ribbon cable, since this is inserted into the two swiveled out housing parts, which are

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then swung back. The two housing parts are appropriately joined, for example, screwed, on the side opposite the guide rail.

In a preferred variant, the housing top is part of a plug-in connector, especially part of the rectangular plug-in connector. The housing top has contact bushings for this purpose to receive contact pins. These are mounted on a plug housing, which is placed on the housing top. It is particularly advantageous if the housing top and plug housing also have means of sealing in order to also achieve degree of protection IP67 for the plug-in connectors.

Such plug-in connectors are known as so-called heavy rectangular plug-in connectors, especially in the field of industrial control and automation technology.

To permit use of the contacting device in a field bus system, for example, in a power bus and/or data bus system, the contacting device is preferably designed as a field bus adapter. Bus subscribers can be connected to the ribbon cable forming the bus lines of the field bus via the adapters.

In an expedient embodiment, the device comprises a control unit, via which the equipment coupled to the field bus can be controlled. For this purpose the control unit has a display and operating element. This has the significant advantage that functions ordinarily arranged in central switch cabinets are arranged decentralized directly in the area of the electrical machine. This increases the user friendliness and simplifies the search for errors, since intricately laid out switch cabinets can largely be dispensed with.

In a particularly expedient embodiment, the adapter has an adapter bottom and an adapter top, in which the latter can be mounted on the adapter bottom. The adapter bottom carries the contacting mechanism, i.e., the contact pins, for contacting with the ribbon cable. The adapter top includes the electronics of the adapter, for example, the electronics of the control unit. The adapter top and adapter bottom are connected to each other in the fashion of a plug-in connector. This has the decisive advantage that the adapter top carrying the electronics can be simply mounted and also simply replaced. This permits the adapter to be easily adapted to different requirements, in which case the adapter top is replaced. The adapter top is preferably also simply replaced for elimination of defects.

A plug connection is preferably integrated in the housing top. The plug connection is configured here, for example, as a connection for a communications line to a communications device or as a connection to a power supply for an electrical load. The plug connection is preferably designed as a connection for a circuit board plug-in connector. Integration of a plug connection in the housing top has the advantage relative to plug-in connectors that the plug connection is arranged internally in the housing top so that means of sealing, as required in a plug-in connector, are not necessary.

BRIEF DESCRIPTION OF THE DRAWINGS

Practical examples of the invention are further explained with reference to the drawing. In the drawing

FIG. 1 schematically depicts an exploded view of a contacting device,

FIG. 2 schematically depicts a section through a contacting device in the installed state and

FIGS. 3 and 4 each schematically depict a housing top in a perspective top view,

FIG. 5 schematically depicts a contacting device designed as a bus adapter.

Equivalent parts are provided with the same reference numbers in the individual figures.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

According to FIG. 1, the contacting device 2 comprises a housing top 4, a gasket 6 and housing bottom 8. A ribbon cable 10 with a number of conductors 12 is inserted between housing bottom 8 and gasket 6.

The housing top 4 has a connection 14 for a round cable. The round cable is introduced into the internal space 16 of the housing top where its conductors are connected to contacting element 18 (cf. FIGS. 3 and 4). Only contact pins or contact screws 20 of the individual contacting elements 18 are apparent in FIG. 1. The contact screws 20 have a contact tip 21 on the end and penetrate the bottom 23 of the housing top 4 in a contact region.

The contact region 22 is fully enclosed by a sealing ridge 24. The sealing ridge 24, also called a sealing rib, therefore forms a continuous elevation on the outside of bottom 23 facing the gasket 6. The housing top 4 also has two side connectors 26 on its bottom, which form a longitudinal recess 28 to receive the ribbon cable 10. The left side connector 26 is then designed as guide element 30. The right side connector 26 has two holes through which screws (not shown) are guided and screwed into corresponding threaded holes 34 in housing body 8 in order to fasten the two housing parts 4, 8 together.

In addition to the threaded holes 34, the housing bottom 8 has two additional fastening holes 36, with which the housing bottom 8 can be fastened to a wall. The housing bottom 8 also includes a guide rail 38 corresponding to guide element 30, as well as two positioning connectors 40 for precise lateral positioning of the ribbon cable 10. Only one of the two positioning connectors 40 is apparent in FIG. 1. The housing bottom 8 is preferably made from a metal, especially a light metal, for example, aluminum, for the best possible stability. The housing top 4 is preferably a plastic injection molded part, the sealing ridge 24 being an integral component of housing top 4. The sealing ridge 24 forms an assembly with housing top 4.

The gasket 6 is preferably designed as a rubber seal and laid out as a flat rubber strip. It preferably has no elevations, recesses or holes. Positioning holes are preferably provided only for its positioning on bottom 23 into which positioning pins fastened on bottom 23 engage (not shown).

The following procedure is used for contacting of conductor 12 with ribbon cable 10: the gasket 6 is inserted in the bottom 23 of housing top 4 and covers the contact region 22. The contact screws 20 at this point protrude only slightly or not at all from bottom 23. The gasket 6 is preferably held in a recess of bottom 23 by means of appropriate retaining elements, for example, the mentioned positioning pin. The housing top 4 is then pushed with its guide element 30 into the guide rail 38 of housing bottom 8. Guide element 30 and guide rail 38 are then configured so that the two housing parts 4, 8 can be rotated or tilted opposite each other. For insertion of ribbon cable 10 between positioning connectors 40, the two housing parts 4, 8 are swiveled away from each other. After insertion, the housing top 4 is fastened to housing bottom 8 by screws. For contacting, the contact screws 20 are now screwed into ribbon cable 10 until the contact tips 21 contact the corresponding conductors 12.

In the contacting device 2 depicted in FIG. 2, for reasons of clarity, the spacings between the individual elements are shown larger than the actually occurring spacings. According to FIG. 2, the sealing ridge 24 is designed triangular when viewed in cross section, i.e., tapers to a point in the direction of gasket 6. During assembly, the tip presses into

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the gasket 6 and reliably seals the housing top 4 so that neither dirt nor moisture can reach the depicted contacting screw 20.

The contacting screw 20 has a thread 42 with which it can be screwed into a threaded element of the housing part 4, for example, a threaded insert 44. The threaded insert 44 is made of conducting material and connected in conducting fashion to a corresponding conductor of the ground cable. During assembly, the contacting screw 20 is passed through gasket 6. The gasket is then displaced. Owing to the elasticity of the sealing material, this is pressed into the threads and therefore causes sealing. In addition, the material displaced by the contacting screw 20 is at least partly entrained outward and forms a bulge 46 around contacting screw 20. This bulge 46 acts roughly like a sealing ring. In the installed state, bulge 46 is generally fully compressed and sealed flat with the bottom of gasket 6.

The positioning connectors 40 are conically shaped in order to permit simple insertion of the ribbon cable 10 and at the same time guarantee precise lateral positioning.

An example of shaping of the guide rail 38 and guide element 30 is shown in FIG. 2. According to it, the guide rail 38 is bent at a right angle when viewed in cross section and forms a protrusion or undercut 48 that keeps the guide element 30 in the vertical position. For fixation in the horizontal position, the guide element 30 is arranged between the guide rail 38 and a positioning connector 40. To permit a tilting movement of housing top 4 relative to housing bottom 8 around a pivot axis 50, sufficient clearance is provided between the bend forming undercut 48 and guide element 30. For this purpose, the bend runs horizontally at the top, while the guide element 30 is designed to run obliquely relative to this top. The guide rail 38 also has a stop 52 that limits the tilt angle. In the swiveled out housing top 4, the housing top 4 comes to lie against stop 52 with a counterstop 54. The pivoting movement around pivot axis 50 is indicated by arrow 56.

According to FIG. 3, several contacting elements 18 are provided in the interior 16 of housing top 4 in the form of connection terminals. Each of these has a mount 58 for the contacting screws 20 and a clamping region 60 for connection of a conductor of the round cable introduced via connector 14. The clamping region 60 is arranged on the side of the contacting element 18 facing away from connector 14. The conductors introduced via connector 14 are fastened in clamping region 60, which is conductively connected to contact screws 20. Four fastening positions 62 for fastening of the housing cover are provided on housing top 4.

An alternative configuration of housing top 4 is shown in FIG. 4, according to which the contacting elements 18 are designed as contact bushings to receive contact plugs. In the practical example four contacting elements 18 are shown. The contact plugs are preferably mounted in a plug housing (not shown in the figure) (also called a counterplug), which can be fastened to housing top 4 via locking pin 64. The housing top 4 forms a plug-in connector with the plug housing. A locking clamp of the plug housing engages in the locking pin 64 in order to connect the plug housing firmly to the housing top. In order to also achieve tightness according to IP67 on the contact surface between the housing top and plug housing, a seal is arranged between the housing parts. Tightness is achieved as soon as the plug housing is pressed onto the housing top by means of the closure mechanism, which consists of the locking pin 64 and the corresponding locking clamps. Such plug connectors are used, for example, in the automotive field and especially in industrial control

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and automation technology, where they are known as so-called "heavy rectangular plug-in connections". The housing top 4 is therefore configured so that it is compatible with the plug housing of such heavy rectangular plug-in connectors ordinarily used in control and automation technology.

According to FIG. 5, the contacting device designed in the bus adapter 66 has an adapter bottom 68 and an adapter top 70. The adapter 66 serves as interface between the bus subscribers of a field bus system and the field bus system. The bus subscriber, for example, electrical equipment/machines and communication equipment, are connected via the adapter to the ribbon cable forming the bus line.

The adapter top 70 in adapter 66 can be mounted on the adapter bottom 68 in the fashion of a plug-in connector. An intermediate seal 72 is provided between the two adapter parts 68, 70 in order to guarantee degree of protection IP67. The adapter bottom 68 includes the contacting mechanism via which the adapter 66 is connected to the ribbon cable. The ribbon cable is passed through adapter 66 via a slit 73.

A control unit 74 having operating element 76 and a display element 78 is integrated in the adapter top 70. The adapter 66 also includes two plug connections as integral component. A power connection 80, via which the power supplied through the ribbon cable is made available to an electrical load, for example, a motor. A communications connection 82 is provided as additional plug connection via which a communications or data processing device can be connected to the ribbon cable. The communications connection 82 is designed, for example, as a connection for a circuit board connector.

This type of adapter 66 is suitable for decentralized control of machines and components in the field bus system. The equipment to be installed can be connected via adapter 66 largely independent of location at any site on the ribbon cable. The layout of a decentralized bus system is therefore made possible with adapter 66.

The adapter top 70 can be replaced simply by positioning on the adapter bottom. Adapter top 70 and adapter bottom 68 are therefore designed as a plug-in connector in which the counterplug or plug housing of such a plug-in connector is already an integral component of adapter 66. Depending on the equipment being connected, the adapter top 70 is designed differently. The adapter 66 is therefore designed in modular fashion, especially as a module. This permits simple and rapid adjustment to local requirements.

Very simple and at the same time very efficient arrangement for sealing of the entire contacting elements relative to the surrounding is guaranteed in the contacting device 2, i.e., also in the adapter 66, by the arrangement of sealing ridge 24. In particular, the use of a flat and continuous sealing plate of gasket 6 is made possible on this account. Whereas reliable sealing between gasket 6 and housing top 4 is determined by the sealing ridge 24, for sealing between gasket 6 and ribbon cable 10, it is decisive that the sealing material is displaced by the contacting screw 20, which significantly contributes to sealing. Because of this configuration, reliable sealing is guaranteed with simple means and a high degree of protection, especially a degree of protection IP67, is reached.

What is claimed is:

1. For use with a single ribbon cable having conductors and an insulating covering, a contacting device comprising:
 - a housing having a housing top and a housing bottom adapted to embrace the single ribbon cable;
 - a plurality of contact screws carried by the housing top to be screwed into the ribbon cable and thereby contact

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the conductors of the ribbon cable by penetrating the insulating covering of the ribbon cable;

a gasket in the form of a flat sealing plate located between the housing top and the ribbon cable to lie flat on an upper surface of the ribbon cable and individually surround the contact screws; and

a sealing ridge projecting from the housing top, wherein the sealing ridge cooperates with the gasket to seal the contact screws, said sealing ridge having a cross section which tapers to a point in the direction of the gasket.

2. A contacting device as defined in claim 1, wherein the sealing ridge is molded onto the housing top.

3. A contacting device as defined in claim 1, further comprising a contacting region, wherein the plurality of contact screws are located within the contacting region, and wherein the sealing ridge completely surrounds the contacting region.

4. A contacting device as defined in claim 1, wherein the gasket has no preformed recesses adjacent the contact screws.

5. A contacting device as defined in claim 1, wherein the contact screws pass through the gasket to cooperatively provide a seal between the contact screws and the gasket.

6. A contacting device as defined in claim 5, wherein the gasket forms continuous bulges around each of the contact screws to seal the ribbon cable to the contact screws.

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7. A contacting device as defined in claim 1, wherein the housing bottom further comprises a guide rail to insertably receive a guide element of the housing top.

8. A contacting device as defined in claim 7, wherein a clearance between the guide rail of the housing bottom and the guide element of the housing top provides for rotation of the housing top with respect to the housing bottom for rotatably opening and closing the housing.

9. A contacting device as defined in claim 1, wherein the housing top is part of a plug-in connector.

10. A contacting device as defined in claim 9, wherein the plug-in connector is a rectangular plug-in connector.

11. A contacting device as defined in claim 1, wherein the device is mounted in a bus adapter for a bus system.

12. A contacting device as defined in claim 11, wherein the bus adapter comprises a control unit.

13. A contacting device as defined in claim 11, wherein the bus adapter comprises an adapter bottom and an adapter top mounted on the adapter bottom.

14. A contacting device as defined in claim 11, wherein the bus adapter comprises at least one integrated plug connection.

15. A contacting device as defined in claim 1, wherein the housing top and the housing bottom are connected to form a hinge with a pivot axis and can be swiveled around the pivot axis.

* * * * *



US005451174A

United States Patent [19][11] **Patent Number:** **5,451,174****Bogursky et al.**[45] **Date of Patent:** **Sep. 19, 1995**[54] **SURFACE MOUNTED PINS FOR PRINTED CIRCUIT BOARDS**2153162 8/1985 United Kingdom .
2209253 5/1989 United Kingdom 439/876
88/04839A1 6/1988 WIPO .[75] **Inventors:** **Robert Bogursky**, Solana Beach;
Kenneth P. Krone; **Bengt E. Nyman**,
both of San Diego; **Irwin Zahn**,
Coronado, all of Calif.[73] **Assignee:** **Autosplice Systems, Inc.**, San Diego,
Calif.[21] **Appl. No.:** **84,579**[22] **Filed:** **Jun. 29, 1993**[51] **Int. Cl.⁶** **H01R 4/02**[52] **U.S. Cl.** **439/876; 439/83**[58] **Field of Search** **439/876, 78, 83**[56] **References Cited****U.S. PATENT DOCUMENTS**4,066,326 1/1978 Lovendusky 439/876 X
4,641,426 2/1987 Hartman et al. 439/876 X
4,678,250 7/1987 Romine et al. 439/876 X
4,968,263 11/1990 Silbernagel 439/246**FOREIGN PATENT DOCUMENTS**0394588A2 4/1989 European Pat. Off. .
0828337 2/1960 United Kingdom .
1540599 2/1979 United Kingdom .
2009528 6/1979 United Kingdom .**OTHER PUBLICATIONS**I.B.M. Technical Disclosure Bulletin, vol. 35, No. 4B,
Sep. 1992, pp. 464-465, "Pin Design for Attaching Pins
to a Ceramic Package By Means of A Solder Without
Solder Climb on the Pin Shank."IBM Technical Disclosure Bulletin Mar. 1991 "Capil-
lary Pin Head"vol. 33 No. 10B pp. 369-371.*Primary Examiner*—Z. R. Bilinsky*Attorney, Agent, or Firm*—Rosen, Dainow & Jacobs[57] **ABSTRACT**

In order to allow header-less connector pins to be di-
rectly surface mounted to a PCB, using a standard pick
and place machine, a novel pin holder is used to hold
the pin while in pockets or holes of a reeled tape and
during its pick and placement by the suction head of the
pick and place machine supplied with the reel. The
holder is configured to permit standard pin spacings of
a row of pins to match standard female connectors, and
to allow observation of the pin during the placement
process. Novel pin designs for use with the holder are
also described.

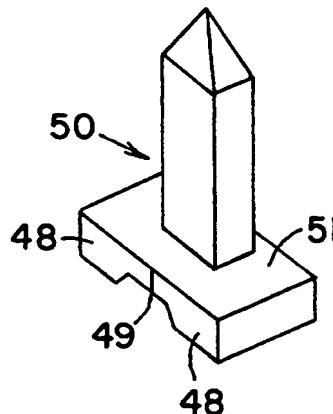
10 Claims, 8 Drawing Sheets

EXHIBIT C

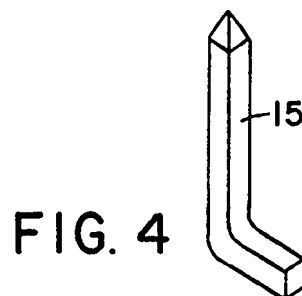
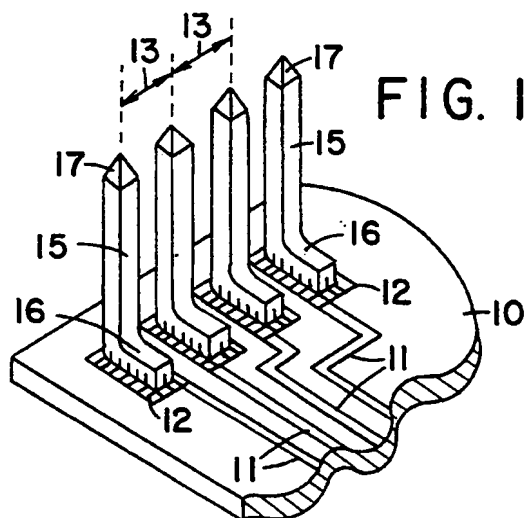


FIG. 2A

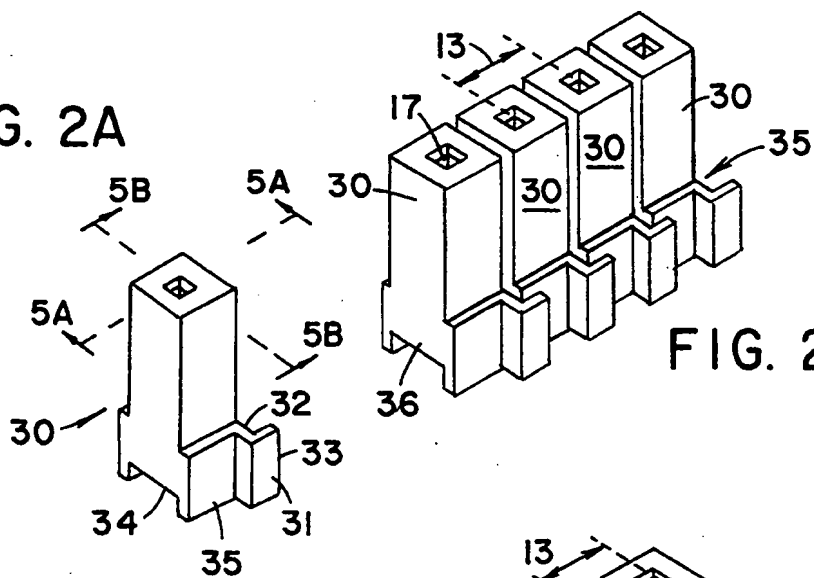


FIG. 3A

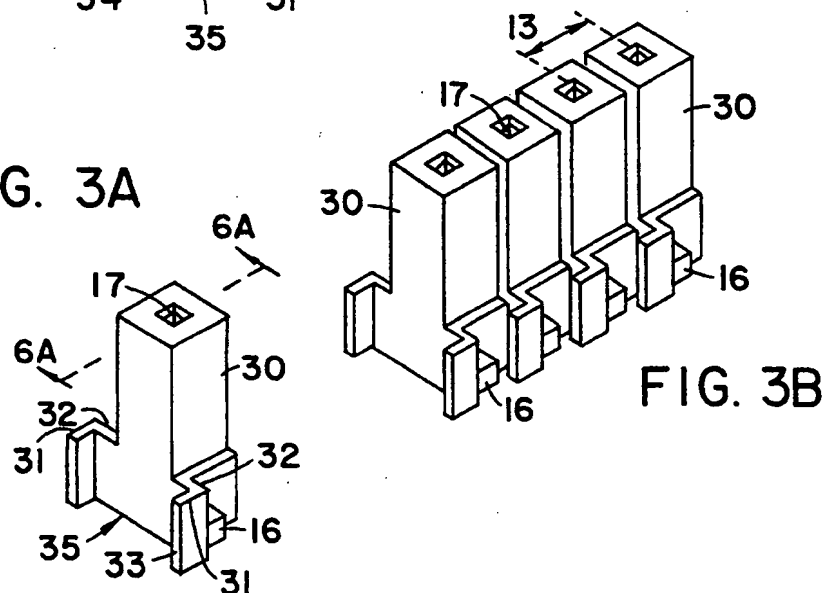


FIG. 5A

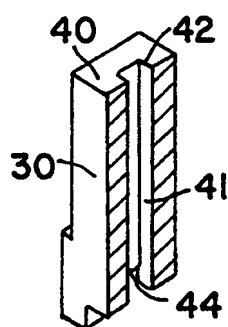


FIG. 5B

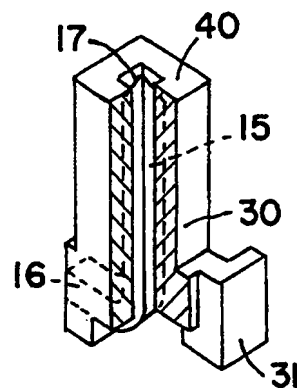
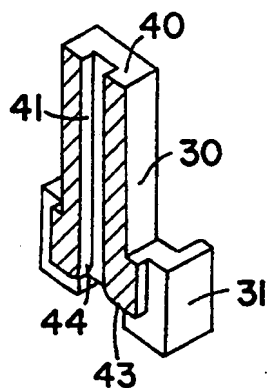


FIG. 5C

FIG. 6A

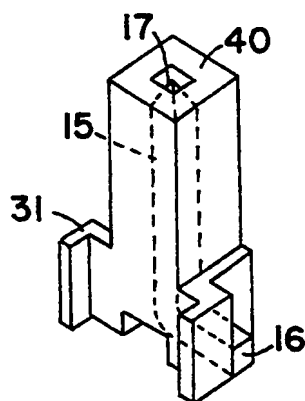
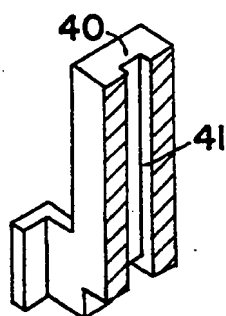


FIG. 6B

FIG. 6C

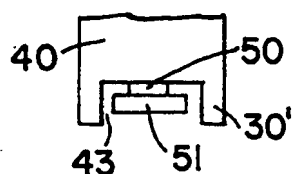


FIG. 6D

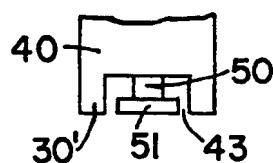


FIG. 7

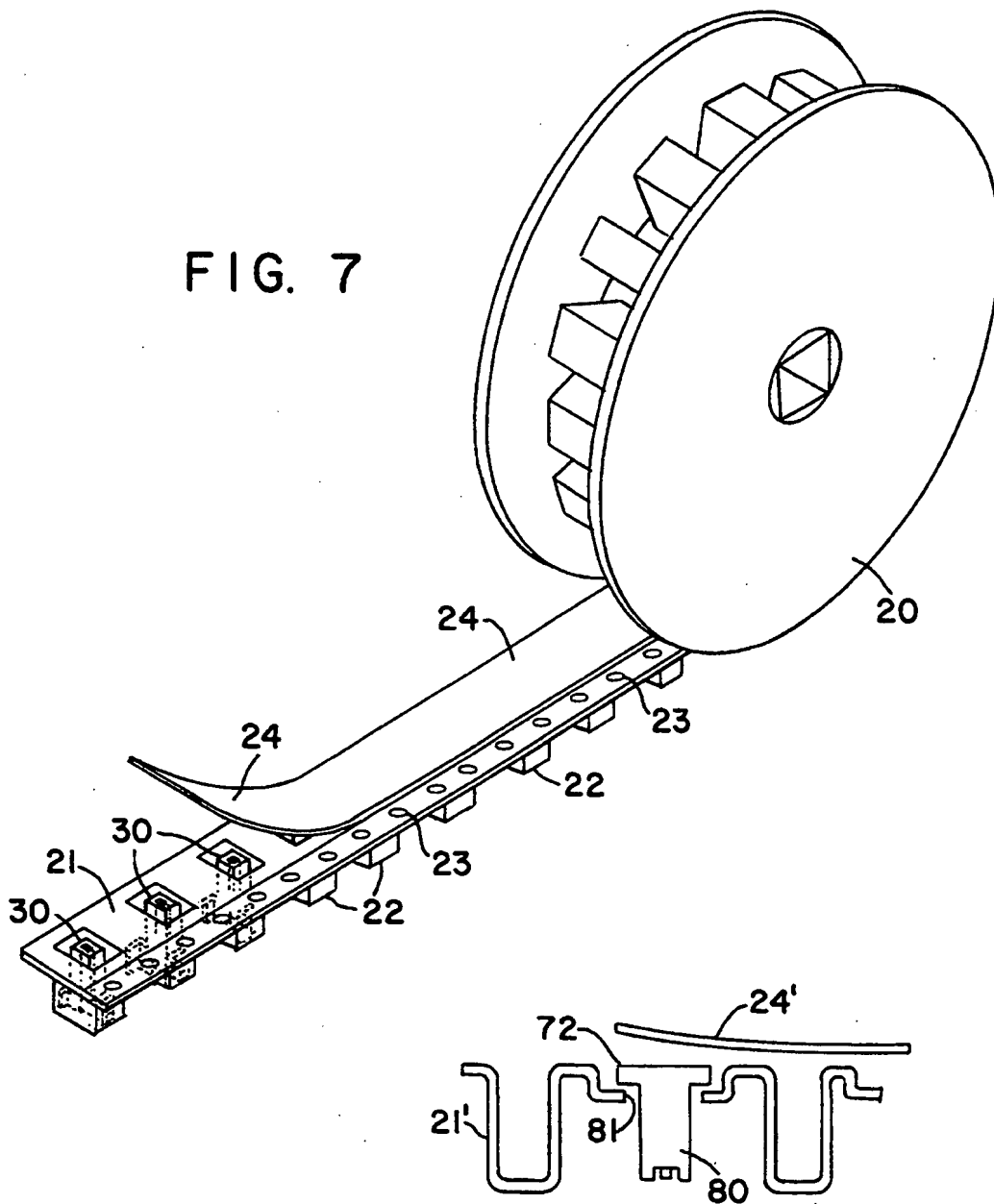


FIG. 7A

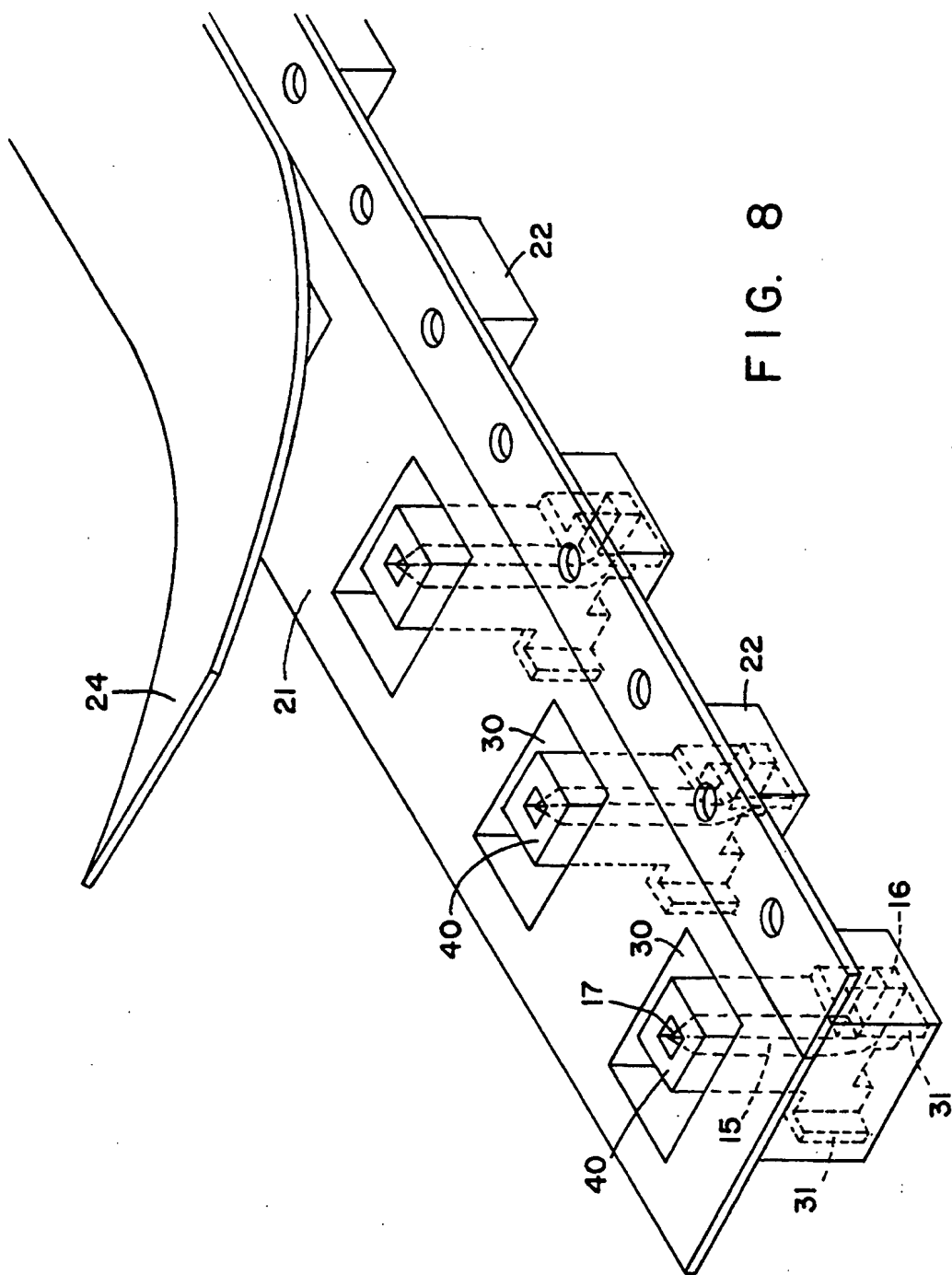


FIG. 9A

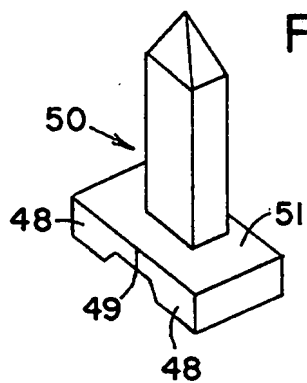


FIG. 9B

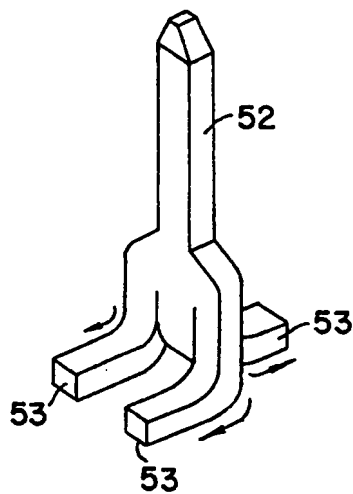


FIG. 9C

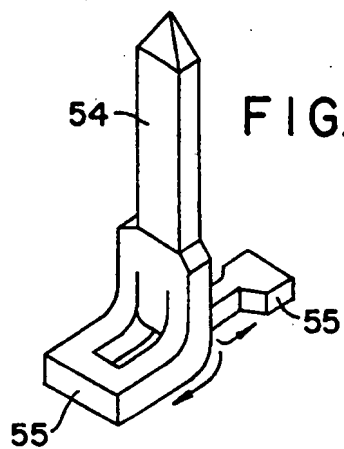


FIG. 9D

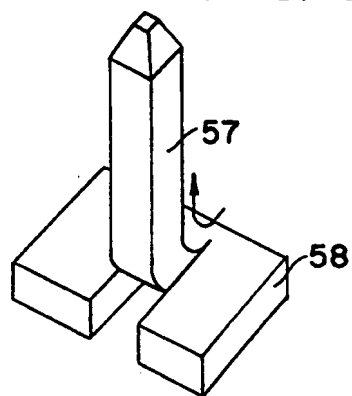


FIG. 9E

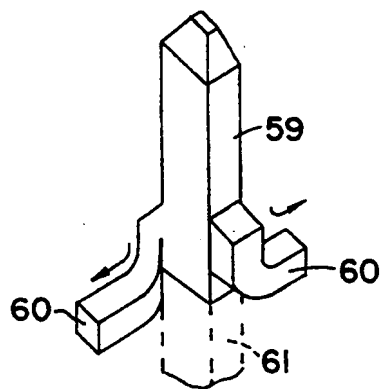


FIG. 9F

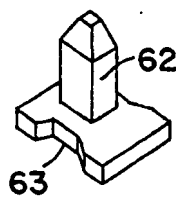
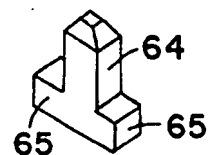


FIG. 9G



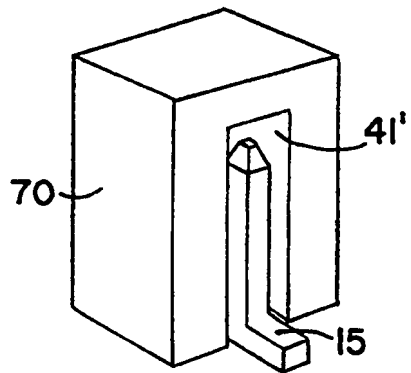


FIG. 10A

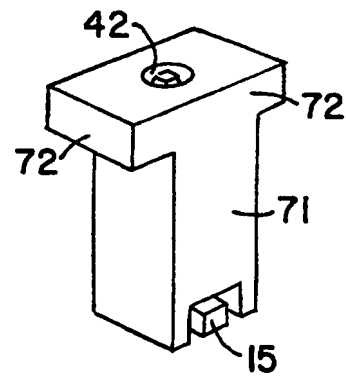


FIG. 10B

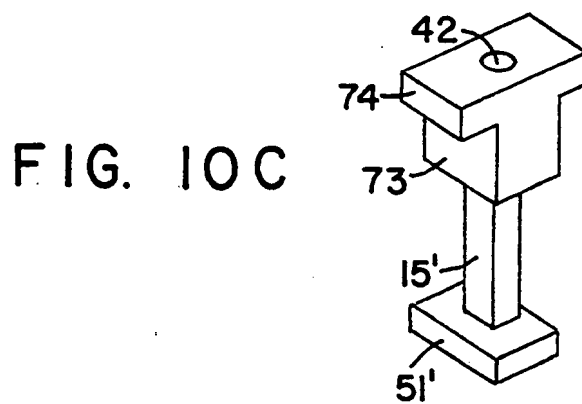


FIG. 10C

FIG. 10D

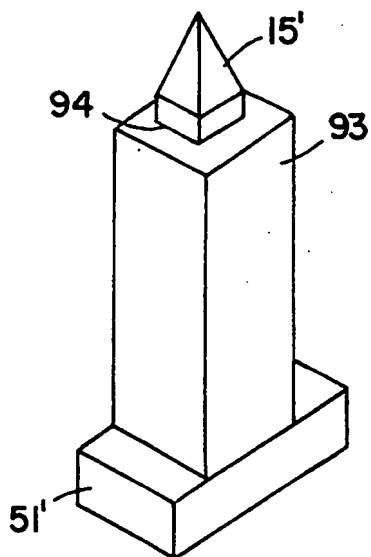


FIG. 10F

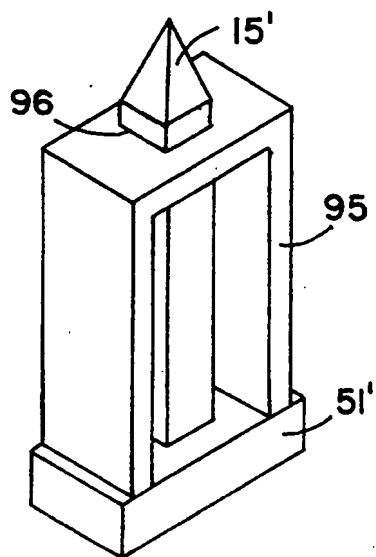
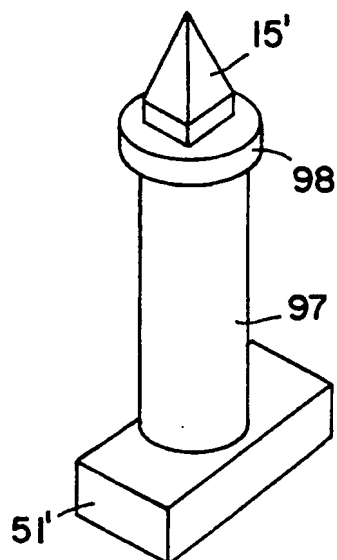


FIG. 10E

FIG. 10G

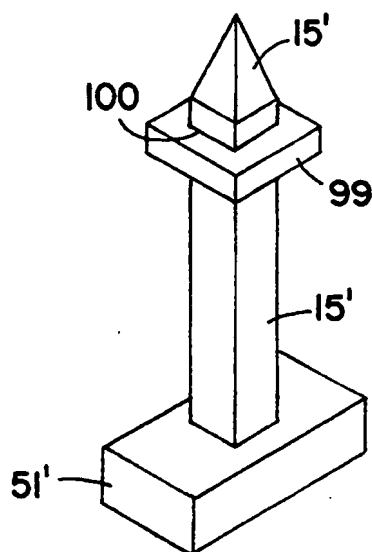


FIG. 11

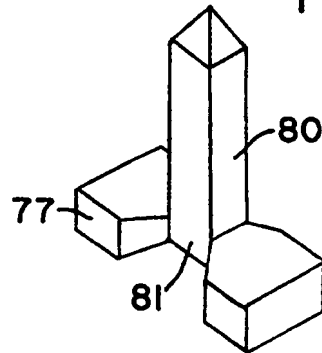


FIG. 13

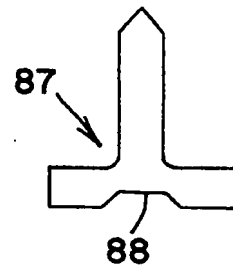


FIG. 14

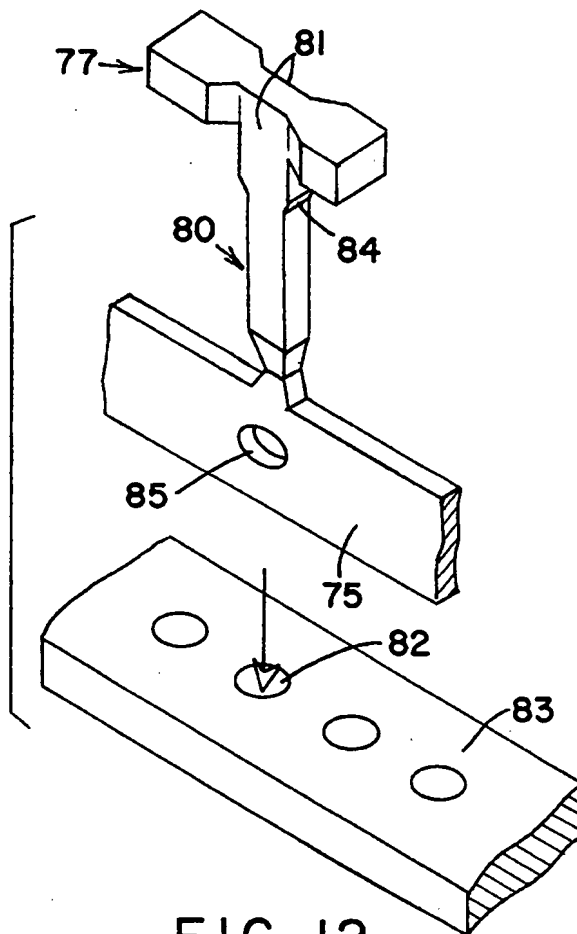
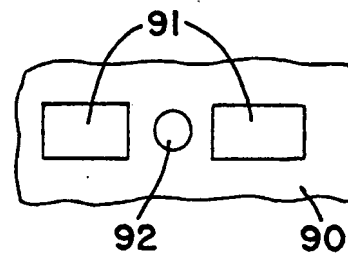


FIG. 12

SURFACE MOUNTED PINS FOR PRINTED CIRCUIT BOARDS

This invention related to methods and apparatus for surface mounting pins to a substrate such as a printed circuit board (PCB).

BACKGROUND

Reference is made to an article by one of us entitled "Six (6) Easy Enhancements of Continuous Pin And Post Terminals", delivered at the Sept. 25-28, 1989 Coil Winding Proceedings Meeting at O'Hare Exposition Center, Rosemont, Ill., whose contents are herein incorporated by reference. This article describes state-of-the-art insertion machines for inserting into a PCB square, rectangular or round pins from a continuous supply of pre-notched, pre-starred pin material wound on a reel. These mounted pins, connected to the printed circuits, are used via female connectors for making external connections to the circuits on the PCB. The article also describes machine inserting into the PCB pin headers containing one or two rows of standard-spaced pins for receiving a multi-hole connector. With the increasing popularity of surface mounting of components, the article shows in FIG. 6 how to machine surface mount header-supported pins, with the header assuring the critical pin pitch uniformity for proper mating with the female connector. The pins are secured in place by bonding to the solder pads on the substrate, i.e., the surface of the PCB.

A popular technique to populate PCBs with components is to use a pick and place machine. The pick and place machine is typically provided with components seated in pockets in a plastic tape supplied from a reel, with the machine using a vacuum or suction head to pick a component from a pocket and place it, as directed by a computer, into its proper location on the PCB.

Attempts to use such standard machines to also pick and place header-supported pins has not, to our knowledge, been successful. A problem is that the same suction head that picks and places components, such as resistors, capacitors, and transistors or ICs, can not reliably pick up the header-supported pins. It is possible to build a machine that uses grippers, not suction, to pick and place header-supported pins, but then assembly costs would increase if two machines are needed to pick up suction and gripper placed components. Moreover, grippers may damage individual pins.

The common way of circumventing the problem is by hand mounting in the following manner. The portion of the pin below the plastic header is bent in alternating gull wing shape. In other words, if there were a four position SMT (surface mount technology) pin header, then the bottom portion of the first pin would be bent at 90 degrees to the left, the second pin would be bent at 90 degrees to the right, etc. This, is the common way of surface mounting pin headers to a board. This, of course, is more costly than machine mounting. Moreover, using a header to support and position the pins results in an assembly that when mounted makes for a higher profile when mated with a female connector. This can be undesirable for small packages. In addition, alternating bends use more space on a PCB.

SUMMARY OF INVENTION

An object of the invention is improved apparatus for machine placement of surface mounted connector pins.

Still another object is novel connector pin configurations for surface mounting to PCBs.

A further object of the invention is apparatus allowing a standard vacuum pick and place machine to pick up and place an individual connector pin or non-header-supported multiple pins for surface mounting to a PCB.

In accordance with one aspect of the invention, we provide a removable pin holder for receiving and holding a connector pin such that a laterally-extending bottom portion of the pin is exposed. The pin holder is configured such that an upper portion is adapted for being contacted and held by the standard suction head of a standard pick and place machine. In this way the suction head can pick up the holder with pin, and place it in the usual way on the PCB for attachment.

As a further feature of the invention, the holder bottom is configured to provide a stable base prior to soldering and to accommodate bent pin ends in various configurations.

Another feature of the invention is a holder configuration that allows an observer to determine whether the holder contains a pin.

Still another feature is that the holder is configured such that when multiple holders holding single pins are positioned alongside one another in a row, their pins, when soldered to the PCB, will have the correct pin pitch for reliable mating with a female connector.

By allowing pins to be mounted with pick and place machines enables many PCBs to be completely component assembled in one machine.

The end product produced by use of the invention will typically be a row of uniformly-spaced connector pins surface-mounted on the solder pads on a PCB, with the pin center line-center line spacing exactly matching the corresponding hole spacing in the female connector or the holes of another PCB, and without a header being needed to support the pins in that critical spacing.

In accordance with another aspect of the invention, a novel tape is provided to support individual pins with holders in such manner as to make it easy for use with a standard pick and place machine.

In accordance with still another aspect of the invention, novel pin configurations are provided that are especially adapted for surface mounting to a PCB. The pins are relatively simple and inexpensive to manufacture. They are provided with a relatively wide base which can be provided with recessed areas to simplify gripping by machine or for receiving excess solder paste or a cement.

The above and further objects, details and advantages of the present invention will become apparent from the following detailed description of preferred embodiments thereof, when read in conjunction with the accompanying drawings.

SUMMARY OF DRAWINGS

FIG. 1 is a perspective view of header-less surface mounted pins in accordance with the invention;

FIGS. 2A and 2B are a perspective view of one pin holder and a row of adjacent pin holders, respectively, in accordance with the invention;

FIGS. 3A and 3B are views similar to that of FIGS. 2A and 2B but from the opposite side;

FIG. 4 is a perspective view of a pin configured for surface mounting;

FIGS. 5A and 5B are cross-sectional views along the lines 5A—5A and 5B—5B, respectively, of FIG. 2A but with the pin removed;

FIG. 5C is a partially sectioned perspective view of the holder of FIG. 2A with the pin in place;

FIG. 6A is a cross-sectional view similar to FIG. 5A of the holder of FIG. 3A;

FIG. 6B is a perspective view of the holder of FIG. 3A showing the pin on the interior;

FIGS. 6C and 6D are side views of the bottom of a pin holder with different sized recesses;

FIG. 7 is a perspective view of pin holders of the invention in a tape supplied from a reel for use in a standard pick and place machine;

FIG. 7A is a perspective view of part of a tape variant;

FIG. 8 is an enlarged view of a section of the tape of FIG. 7;

FIGS. 9A to 9G are perspective views of various pin configurations that can be employed in the invention;

FIGS. 10A to 10G show in perspective other holder variants in accordance with the invention;

FIG. 11 is a perspective view of a preferred pin configuration in accordance with the invention;

FIG. 12 illustrates manufacture of the pin of FIG. 11 and its insertion in a header strip;

FIG. 13 is a side view of a variation of the pin of FIG. 11;

FIG. 14 illustrates mounting of a pin of the type shown in FIG. 13.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

FIG. 1 shows one possible end product produced by carrying out the invention. A PCB 10 serving as a substrate has the usual laminated and etched conductors 11 leading to other surface-mounted components (not shown) and terminating in individual solder pads 12. To each of the solder pads 12 is soldered a connector pin 15. Each pin 15 is configured to have a lower bent or otherwise enlarged end portion 16 and a point or taper 17 at its upper end. The pins 15 form a row of uniformly-spaced pins, the center line-to-center line spacing being indicated by 13. That spacing 13 is selected to accurately match the corresponding spacing between the hole center lines of a standard female connector (not shown) adapted to mate with the row of pins 15 at their pointed ends 17. What is unique about the assembly shown is that it was machine mounted, and no pin header is present.

In particular, the assembly shown in FIG. 1 was made with a standard pick and place machine, for example, those supplied by Fuji, Panaset, Universal, Sanyo, and others, which employ a standard suction head designed to pick up components and place them on a PCB in accordance with a program-controlled computer. The machines are conventionally supplied with a feeder reel of components. As illustrated in FIG. 7, on a reel 20 is wound a plastic tape 21 which contains a series of pockets 22 for housing components. One edge of the tape 21 is supplied with a row of sprocket holes 23 for feeding the tape and aligning the pins with the vacuum pick-up head. The components inside the pockets 22 are prevented from falling out by a plastic cover tape 24, which is peeled off as shown during use to expose the underlying components in the pockets for access by the machine's suction head (not shown). The pick-up of the component from the tape and its alignment and placement on the PCB is conventional and need not be further described. Similarly, the soldering of the placed components (usually held in place by a drop of adhesive

or solder paste) to the solder pads and traces by, for example, wave soldering or Infrared (IR) Reflow is also conventional and need not be further described. The invention concerns the manner of handling in such a machine connector pins as distinguished from the usual active and passive electrical components.

Since it was found virtually impossible for the suction head of the standard pick and place machine to pick up a pin 15 directly, a feature of the invention is to provide a removable pin holder for a single pin that can be picked up by the machine's standard suction head. One form of such a pin holder 30 is shown in FIG. 2A. The holder 30 comprises a generally vertically elongated member having stabilizing legs 31 at the bottom extending outwardly 32 from opposite sides and laterally 33 (rearwardly as viewed in FIG. 2A). At the front surface as viewed in FIG. 2A, at the base is provided a cut-away section or slot 34.

FIG. 2B shows a row of holders 30 placed in contact with one another by a pick and place machine. As will be noted, the legs 31 form a sort of seat or receptacle 35 for receiving the body portion 36 at the base of the adjacent holder 30. The dimensions of the body 30 are chosen such that, when aligned in a row as illustrated in FIG. 2B, the center line-to-center line spacing 13 of the pins held on the inside exactly matches that needed to mate with the connector. In effect, the row of nested holders acts as a temporary header to properly position the pins before and during the soldering operation.

FIGS. 3A and 3B are views similar to FIGS. 2A and 2B but from the opposite side, which also shows that the holders 30 can be positioned in the reverse manner should the location of other components interfere with the FIG. 2B position.

FIGS. 4-6D show further details of the holder's internal construction. The holder 30 has a generally flat top 40 providing sufficient surface area so that the suction head can easily pick it up. A hole 41 extends vertically through the body 30, terminating at the top in an opening 42 and at the bottom in an enlarged recess 43 exposed at the bottom. The hole 41 is sized to receive and hold by a press or interference fit the vertical part of the pin 15, so that when the holder 30 is pressed onto the pin and the holder lifted, the pin will be carried upward by the holder. The pin cross section can be rectangular, square or round. Alternatively, a small section of the vertical part of the pin can be enlarged to provide an interference fit that allows the pin to be carried by the holder. The height of the holder 30 is chosen so that the pin tip 17 is at or just below the surface 40 and is visible through the opening 42.

FIG. 5C shows in phantom one pin 15 inside the holder 30. The recess 43 at the bottom is sized to accommodate the bent end 16 of the pin 15 via a channel 44 passing to the outside, which prevents the pin from rotating within the holder 30. The height of the recess 43 is larger than or just matches the thickness of the pin end 16, so that the bottom surfaces of the pin end 16 is higher than that of the holder 30 to allow room for the solder pad and paste, or lies in substantially the same plane, as shown in FIG. 6D. FIG. 6C shows a pin base 51 above the holder bottom 30', and FIG. 6D shows where the two are substantially co-planar. The pins 50 depicted here are similar to Chat of FIG. 9A.

FIG. 7 shows the holders 30 each with a pin 15 seated in one of the tape pockets 22. The enlarged view of FIG. 8 provides more details. In this preferred embodiment, the top flat surface 40 of the holder 30 lies just

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below or at the top of the pocket 22, so that, when the cover tape 24 is lifted off, the holder 30 with pin 15 inside is easily picked up by the suction head in the same manner as any other component—the typical suction head usually only goes to the pocket surface, not inside—and thus can be automatically placed in its proper position on the PCB.

The tape 21 need not have walled pockets 22, though the latter are preferred. In the variant illustrated in FIG. 7A, holders 80 (with pins) of the type illustrated in FIGS. 10B and 10C, with shoulders 72, 74 can be supported in holes 81 in a tape 21', the overlying cover tape 24' preventing the holders 80 from falling out of the holes 81.

The holders 30 are preferably constituted of any high temperature plastic, for example, such as Polyphenylene Sulfide (PPS) or liquid crystal polymer (LCP), that can withstand the temperature of the reflow soldering, typically 230°–260° C. The holder 30 thus remains in place during the soldering process, and is removed and reused or disposed of after the pins have been soldered in place. The hole 42 on top may be used to observe the pin 15 inside to ensure all pins are in place before the soldering operation proceeds, and is close fitting to the pin to allow sufficient suction by the pickup head.

FIGS. 10A, 10B, and 10C show other holder configurations in accordance with the invention. In the FIG. 10A holder 70, the hole 41' is a slot, open at one side as shown. The holder 70 is adapted for side entry of the pin 15. No hole on top is necessary since the pin 15 can be observed through the open side. As before, the slot 41' dimensions provides an interference fit with the pin or a pin section.

The shape of the holder 71 in FIG. 10B provides a shoulder 72 to facilitate removal of the holder 71 following the solder operation. The FIG. 10C embodiment is adapted for IR soldering of the pin 15'. The holder 73 is a shortened version of that depicted in FIG. 10B with a shoulder 74. The shortened holder height allows it to accommodate various pin heights, eliminates the need for a holder base, since the holder 73 is held in place on the pin 15' by the friction fit, and avoids shielding the pin bottom from the IR heating rays. Also note that the modified holders in FIGS. 10A–10C lack the stabilizing legs 31 in FIGS. 5 and 6 since their bases can be shaped to stand alone, or are unnecessary as in FIG. 10C, and nesting of adjacent holders can be accomplished by other means. The pin 15' in FIG. 10 has a stand-alone base 51' similar to that of FIG. 9A.

With a pin 15' with a stand-alone base 51', other shapes of holders are also possible, which can be made of the indicated plastics or equivalents by extrusion or molding. Thus, FIG. 10D shows a holder 93 configured as a prism with a center hole 94 for receiving the upright portion of the pin 15' in a friction fit, and providing a larger surface area on top for the suction head. FIG. 10E shows an arrangement in which the holder 95 is U-shaped with two legs on the long sides of the pin base 51'. The holder 95 can also be rotated 90° and narrowed to fit on the shorter side of the base 51'. The friction fit is provided at the hole 96 in the bight portion of the U-configuration. In the FIG. 10F embodiment, the holder 97 has a cylindrical bottom part and a circular shoulder 98 at the top. The cylindrical bottom part can be shaped as a quadrangular prism. The holder 93 in FIG. 10D can also be made cylindrical. The holder 99 in FIG. 10G differs from the others in that it consists solely of a rectangular stiff cut-out from a plastic strip

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or sheet provided with the usual hole 100 for the friction fit support of the pin 15'. If desired, the strip-shaped part 99 can be circular as well as square or rectangular. In all four examples, an enlarged top surface is provided for suction pick-up, and the holder top part has a close fit with the pin top to preserve the suction (prevent leaks) when the suction head comes down on top to pick-up the holder carrying the pin for placement on the PCB or other substrate.

FIGS. 9A to 9G depict modified forms of pins in accordance with a feature of the invention and that can be used with the holder of the invention, which however will require re-shaping of the bottom recess 43 and channel 44 to accommodate the differently-shaped base configurations. FIG. 9A shows a pin 50 having a square or rectangular base 51 for soldering to the solder pads 12 of the PCB.

A feature of the pin 50 is the provision of a recess 49 at the bottom of the base 51. When the pin 50 is used on a substrate to undergo reflow soldering, solder paste is used to hold the pin in place when in an upright position. The recess 49 serves to accommodate excess solder paste squeezed out when the pin is placed on the pads. Similarly, in wave soldering, the pin is usually upside down but held in place by a drop of adhesive, usually epoxy. The recess 49 acts as a convenient receptacle for the epoxy to prevent spreading to the adjacent contact areas 48.

FIG. 9B shows a pin 52 that employs legs 53 extending in opposite directions, formed as shown by the arrows by bending out the bottom parts of a stamped configuration. FIG. 9C shows a pin 54 with another way of configuring the base legs 55. FIG. 9D shows a pin 57 with a base 58 somewhat similar to that of the pin of FIG. 9A. Again, after stamping out a flat piece, a center portion is bent upward, shown by the arrow, to form the upstanding pin portion 57 on the base 58. While in most cases, as illustrated, the pin portion extends perpendicular to the base, there may be applications where, due to space constraints, the pins are angled to the substrate, for example at 45° or at other angles.

FIG. 9E shows a pin 59 with oppositely extending legs 60 with an in-line carrier post 61 for receipt in a center hole in the solder pad 12. FIG. 9F shows a pin 62 similar to that in FIG. 9A, except that recesses 63 are provided at the sides to allow adjacent components to be closer. FIG. 9G provides a pin 64 configuration in which the base comprises wing sections 65 on two sides, which again allows closer mounting of adjacent components. It will also be noted that when a pick and place suction head is to be used which fits over the upstanding pin position, it is desirable that the base area completely surrounds the pin so no suction is lost. The pins shown at FIGS. 9A and FIG. 9F have this feature.

The different base configurations also illustrate the different manufacturing techniques. For example, the FIG. 9A pin can be one-piece or assembled 2-pieces. The FIGS. 9B–9E pins are more easily made in one-piece by strip forming techniques involving stamping, bending and flattening operations. The bending operations are indicated by the arrows in each figure. It is readily easy to configure the bottom recess of the holder 30 to accommodate the different bases shown in FIGS. 9A–9G.

FIG. 11 shows a preferred one-piece pin configuration which has the feature of simple manufacture from a strip. In this case, from the strip are stamped out sec-

tions having a carrier part 75 (FIG. 12) which supports a plurality of pins 76, one only of which is shown in FIG. 12. The upper end is then cold-headed or otherwise configured into the bow tie shape shown at 77. The resultant pin 78, when separated from the carrier strip 75, is shown in FIG. 11, and comprises the usual upstanding part 80 attached to the bow tie base 77. The recesses 81 on opposite sides forms a gripping area when it is desired to insert the pin, by way of automatic machine pickup from the base side, pointed end first, into an aperture 82 in a conventional insulating header strip 83, shown by the arrow. The pin 80 is detached from the strip 75 before the insertion step. The ridge 84 can be provided to assist in holding the pin in the hole of the header 83. The recessed areas also act as convenient receptacles for excess solder paste when the pin base 77 is surface mounted. The hole 85 on the carrier strip is used for indexing the strip 75.

This pin configuration, with a thick, heavy, wide base, thus lends itself to efficient manufacture in a high speed progressive stamping die from a strip, and also allows selective plating, with for example solder at the base end and gold at the terminal pin end. Also, the bow tie shape of the base facilitates soldering.

FIG. 13 shows a modification 87 in which a recess 88, similar to 63 in FIG. 9F, is provided to serve as a receptacle for an epoxy dot. FIG. 14 shows part of a PCB 90 with spaced solder pads 91, with an epoxy dot 92 in the space between the pads 91. The pin 87 of FIG. 13 can be mounted on the PCB so that the recess 88 overlies and contacts the epoxy dot 92, with the adjacent land areas on the pin base seated on and contacting the solder pads 91. Such a configuration is useful for narrow stand-alone pins on close pin-to-pin centers.

When used with holders, after the pins have been inserted and located in their respective holders 30, each holder and pin is placed in a pocket of the tape, the cover applied and sealed, and the tape then wound onto a standard sized reel for distribution to PCB assemblers.

Pins can be used in single or multiple form not only as connector components but also as test points. Not only can holders be made to accommodate a right angle pin where required, but they also can be configured to accommodate a tab or lug (flat blade) to be surface mounted as well. Pins of the type described here are typically made of copper alloys, such as brass or phosphor bronze.

Summarizing, the benefits of the invention are:

Allows pins (without a plastic header, hence low profile and cost) to be surface mounted to a PCB;

By packaging the pins in a tape and reel format, the benefit is that the entire PCB can be populated with components with one pick and place machine. Moreover, in those applications where non-vacuum, gripper type pick and place machines are used, the holders will facilitate pickup of the pins and will avoid damage to the pins by the gripper.

The novel pin configurations, used with or without the holders, led themselves to low cost, high speed manufacture and the various base shapes are well adapted for gripper or suction pick-up and to accommodate solder or adhesive materials.

While the preferred application of the invention is pins surface mounted on PCBs, the invention is not limited to that application, and can be used where one or more pins are to be surface mounted on any kind of a substrate with or without conductive traces or other components.

Although there have been described what are at present considered to be the preferred embodiments of the invention, it will be understood that the invention may be embodied in other specific forms without departing from the essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative, and not restrictive. The scope of the invention is indicated by the appended claims rather than by the foregoing description.

What is claimed is:

1. A header-free electrical terminal pin for surface mounting on a substrate, said pin comprising;

- (a) a stand-alone base portion,
- (b) an individual upstanding pin portion integral with and electrically connected to the base portion,
- (c) said base portion having a surface for soldering to the substrate and extending substantially in a given plane,

said upstanding pin portion extending in a direction substantially perpendicular to said given plane and having opposite sides extending parallel to said substantially perpendicular direction,

(d) said soldering surface extending at least around opposite sides of said upstanding pin portion,

(e) said soldering surface having a recessed area for accommodating solder or adhesive paste.

2. The terminal pin of claim 1, wherein the pin portion has four sides and the base portion extends completely around all four sides of the upstanding pin portion.

3. An header-free electrical terminal pin for surface mounting on a substrate, said pin comprising:

- (a) a stand-alone base portion,
- (b) an individual upstanding pin portion integral with an electrically connected to the base portion,
- (c) said base portion having a surface for soldering to the substrate and extending substantially in a given plane, said upstanding pin portion extending in a direction substantially perpendicular to said given plane and having opposite sides extending parallel to said substantially perpendicular direction,
- (d) said soldering surface extending at least around opposite sides of said upstanding pin portion,
- (e) said base portion and upstanding pin portion being constituted of one-piece metal and bent to extend in substantially orthogonal directions.

4. The terminal pin of claim 3, wherein the base portion comprises leg portions bent to extend out from opposite sides of the upstanding pin portion.

5. The terminal pin of claim 3, wherein the upstanding pin portion is bent to extend upward from the base portion.

6. A header-free electrical terminal pin for surface mounting on a substrate, said pin comprising:

- (a) a bow-tie shaped stand-alone base portion,
- (b) an individual upstanding pin portion integral with the base portion,
- (c) said base portion having a surface for soldering to the substrate and extending substantially in a given plane, said upstanding pin portion extending in a direction substantially perpendicular to said given plane and having opposite sides extending parallel to said substantially perpendicular direction,
- (d) said soldering surface extending at least around opposite sides of said upstanding pin portion.

7. The terminal pin of claim 6, wherein the upstanding pin portion has a pointed end, and said soldering

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surface has a recessed area for accommodating solder or adhesive paste.

8. The terminal pin of claim 6, further comprising a ridged portion on the upstanding pin portion.

9. The terminal pin of claim 1, wherein the pin portion has a width parallel to the given plane, said base portion in the given plane having a width greater than that of the pin portion.

10. A header-free electrical terminal pin for surface mounting on a substrate, said pin comprising:

(a) a stand-alone base portion,

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(b) an individual upstanding pin portion integral with and electrically connected to the base portion,

(c) said base portion having a surface for soldering to the substrate and extending substantially in a given plane,

said upstanding pin portion extending in a direction substantially perpendicular to said given plane and having opposite sides extending parallel to said substantially perpendicular direction,

(d) said soldering surface extending at least around opposite side of said upstanding pin portion.

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RELATED PROCEEDINGS APPENDIX

None.